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[OFFICIAL NOTICE.]

Twenty-Third Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 9, 1900.

The twenty-third annual meeting of the Western Gas Association will be held in Chicago, May 16, 17 and 18, 1900, and will be called to order by the President, Mr. Wm. McDonald, of Albany, N. Y., at 9:30 A. M., Wednesday, May 16th.

The Auditorium Hotel has been selected as headquarters, and the meetings will be held in a suitable room contained therein. The following rates have been obtained for members and any who may attend the meeting:

European Plan.—$2.50 per day and up; two, in one room, $1.50 per day each, and up; room with bath, one person, $3.50 per day; two persons, $5.

American Plan.—$4 to $5 per day.

The Executive Committee has arranged for the presentation of the following papers:

"Candle Power: Its Present Relation to the Gas Industry;" by Mr. Jno. R. Lynn, Portsmouth, Ohio.

"The Operation of a Central Station Electrical Plant with a Gas Engine;" by Mr. J. C. Small, Aurora, Ind.

"Public Control of Rates;" by Mr. Geo. McLean, Dubuque, Iowa.

"The Systematic Location of Gas Mains as Opposed to a Conduit;" by Mr. Donald McDonald, Louisville, Ky.

"Temperatures in Condensation;" by Mr. W. H. Barthold, Grand Rapids, Mich.

"Regenerative Benches;" by Mr. Howard C. Slater, Milwaukee, Wis.

"Monthly Technical Report of Operations in Coal Gas Works;" by Mr. W. E. Steinwedell, Belleville, Ills.

"The Hygienic Effect of the Use of Gas;" by Mr. Thos. D. Miller, Dallas, Texas.

"Wrinkle Department;" Edited by Mr. Fred. H. Shelton, Philadelphia, Pa.

Reports will be received from the Committee on Cyanides and from the Committee on Isolated Generators for Bench Firing. Mr. Somerville will present a "Short Topic" relating to an experience in telescoping a gas holder.

The Western Passenger Association, from points in Eastern and trans-Missouri territories, Central Passenger Association, Trunk Line Association, Southeastern Passenger Association, Wisconsin Central Lines, Chicago, Rock Island and Pacific Railway Company and the Chicago and Alton Road, have granted rates of one and one-third fare for the round trip, conditioned on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all State divisions east of the Mississippi river, except New England. The following States and Territories west of the Mississippi river are in the territory covered by the Railway Associations granting reductions: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first-class ticket at

starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears as same has purchased, at full tariff fare, one first-class ticket to Chicago, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser to a one third rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Chicago, obtaining a certificate which will, if properly endorsed in Chicago, entitle them to a one-third fare returning to place from which certificate was obtained, provided it is endorsed by a representative of the Passenger Associations, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult local agents several days in advance of purchasing ticket to Chicago, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can re-buy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

A beefsteak dinner, to be provided by the Association, will be held Thursday evening, at the Chicago Athletic Club, tickets for which will be sold at $5 each. While the ladies will not participate in the dinner, arrangement will be made for their entertainment.

As it is necessary that arrangements for this dinner should be perfected at an early date, it is requested that all those who expect to attend the meeting will notify Mr. H. D. Harper, Chicago, Ills., of the Committee, as early as possible of the number of tickets they will require.

All queries sent to the Secretary for the Question Box will be assigned, in advance of the meeting, to members for answer.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association. JAMES W. DUNBAR, Secy.

BRIEFLY TOLD.

PERSONAL—MR. JOHN DELL.—Many will wonder with us over the cause that impelled Mr. John Dell, for twenty years or so the outside representative of the Laclede Fire Brick Manufacturing Company, of St. Louis, Mo., to resign that position; but whether we wonder or not, the fact is that his resignation was tendered and accepted, and it is to be regretted that such results were reached, if the resignation goes that the honorable gentleman means to retire from the trade. Cheery, brisk and always welcome, Mr. Dell's absence from the haunts that he helped by his presence to brighten would be too marked; so we hope in a week or so to say that he proposes to try on his own account the fields that in the years gone by he faithfully tilled for others. No matter what he proposes to do, those who know him we are sure will join us in wishing the best of good luck to him.

NOTES.—Regretfully we make the announcement of the death of Mr. Theodore B. Sheldon, who died at his home in Red Wing, Minn., the morning of the 3d inst. Deceased, who was in his 81st year, was one of the organizers of the Red Wing Gas Company and was elected President thereof, June 15th, 1872. When the consolidation of the gas and electric lighting interests of Red Wing was perfected some time ago, through the formation of the Red Wing Gas and Electric Company, Mr. Sheldon was named President thereof. He was a native of Bernardstown, Franklin county, Mass., in which village he was born, January 31, 1820. In 1856 he settled in Red Wing, where his career was one of uninterrupted prosperity.——At the annual meeting of the Port Jervis (N. Y.) Gas Company the stockholders were evidently well pleased over the doings of their representatives, for, having adopted a motion to declare the usual dividend (which is at the rate of 6 per cent. per annum) they re-elected the following officers: Directors, J. P. Westcott, Geo. F. West, C. E. Cuddeback, E. M. Gordon and John Collins; President, J. P. Westcott; Vice-President, Geo F. West; Treasurer, E. C. Hersey; Secretary, C. E. Cuddeback; Superintendent, John Collins. The reports showed a good increase in sendout for the twelvemonth, and that the main system had been extended by the placing of about a mile of pipe.——At the annual meeting of the Newport News (Va.) Gas Company the officers chosen were: Directors, J. W. Curtis, Samuel Regester, D. C. Zollikoffer, W. J. Payne and W. S. Bowen; President, W. J. Payne; Vice-President, J. M. Curtis; Secretary and Treasurer, D. C. Zollikoffer; Supt., W. S. Bowen.

[Concluded from page 575.]

PROCEEDINGS, SIXTEENTH ANNUAL MEETING, OHIO GAS LIGHT ASSOCIATION.

HELD IN CONVENTION HALL, CHITTENDEN HOTEL, COLUMBUS, OHIO, MARCH 21 and 22, 1900.

SECOND DAY, MARCH 22—MORNING SESSION.

The proceedings for the second day were begun, pursuant to adjournment. The President introduced Mr. B. E. Chollar, of St. Louis, Mo., who read the following paper entitled

SOME NEW IDEAS ABOUT OXIDE PURIFICATION.

In order to carry on the purification of gas with best success, two conditions are especially requisite, viz.: Clean gas and clean oxide. By the term clean, I mean mechanically clean; that is to say, not dirty with tar or other contaminating substance.

There are several forms of iron oxide that may be used. The hydrated ferric oxide, found as a natural ore or manufactured artificially; anhydrous black ferric oxide, found in a natural state, and oxide made by the rusting of iron borings, being anhydrous and strongly magnetic.

It has been, and is now, commonly supposed that the hydrated sesquioxide of iron is the best form of oxide, and that the anhydrous forms of oxide are comparatively inefficient; but, so far as my own experience goes, and it is supported by many, the anhydrous forms are far the better, for when the hydrated forms are used they become to a great extent changed to the anhydrous form during the first revivification.

In the purification of gas with ferric oxide without admission of air, sulphuretted hydrogen combines with the oxide to form ferrous sulphide, which is left in the foul box. This may be shown to be true by treating fresh spent oxide with dilute sulphuric acid, whereupon sulphuretted hydrogen is copiously set free.

On removing the spent oxide from the box and spreading it out to revive, it heats up quickly, revives rapidly, and requires careful watching to prevent spontaneous combustion. Reviving the same in the box by means of an air blast requires still more care. During the process of revivification the mass is converted to the anhydrous form of oxide and sulphur deposited. When air is admitted with the gas, the process of purification is quite different. The fresh spent oxide shows little or no indication of ferrous sulphide, and, when treated with diluted sulphuric acid, gives off little or no sulphuretted hydrogen. It seems to be an oxidized form of iron mixed with sulphur—a substance incapable of further purification of gas, but still capable of being revived.

The mass revives more slowly than when air is not admitted. It can, therefore, be revived in the box by means of an air blast with comparatively little danger of accident from fire.

When air is admitted in proper proportion, and the direction of the flow through the beds reversed at proper intervals, a new process is effected, the action of which is as follows:

When foul gas mingled with air enters a purifying bed, the hydrogen sulphide attacks the ferric oxide reducing it to ferrous sulphide and ferrous oxide. The ferrous sulphide so formed is immediately converted into ferrous oxide and the sulphur deposited.

Ferrous oxide will not combine with hydrogen sulphide, nor can air, in the presence of a large proportion of hydrogen sulphide, oxidize it to ferric oxide. As the gas flows through the bed, the proportion of hydrogen sulphide continually decreases, while the quantity of air present remains practically the same; hence the intake part of the bed will be reduced to ferrous oxide before the remaining part has lost its activity. If, therefore, at this time the direction of flow be reversed, the clean half of the bed will remove the hydrogen sulphide as before, leaving the full proportion of air, with the gas free to revive back to ferric oxide the part of the bed that has previously been fouled.

The same conditions hold true with boxes as with beds. When one box becomes foul, the other being able to do work, the foul box can be placed last in the series and revived to an active state ready for another reversal. The clean gas flowing through fouled oxide will not absorb impurities therefrom.

Discussion.

The President invited Mr. D. McDonald to start the discussion.

Mr. McDonald—One thing that strikes me in the paper is the statement that gas will not absorb impurities from the fouled oxide. If so we could afford to reverse the flow through a number of boxes as well as through a single box. In other words, in a set of four boxes, by making a foul box of the last one you could get a very much higher

duty out of the oxide without making any change. Is that true, Mr. Chollar?

Mr. Chollar—You can use as many boxes as you please. The conditions hold true with one or two or any number of boxes.

Mr. McDonald—You cannot only reverse the flow through a single box, but also reverse it through a set of boxes, so as to make the foul oxide box the last one.

Mr. Chollar—Certainly. You can reverse the flow through a single box or through any number of boxes.

The President—Mr. Doherty, have you anything to say?

Mr. Doherty—I seldom have anything to say unless I can disagree with a man. I have to agree with Mr. Chollar this time. I do not always, but I do now. The process he speaks of I am quite sure is properly described, and it will as a matter of fact take place. I disagreed with Mr. Chollar six months ago, and have been studying up for the last six months to get the better of him on this subject. However, I think his paper is a very valuable one, and that there is no kind of a purifying box that this may not be applied to with a proper valve arrangement. Mr. Chollar has a very neat, simple form of valve arrangement for his own boxes, which would be just as applicable to the old horizontal boxes that most of us have to use in spite of the fact that there are better boxes in existence.

Mr. Persons—I laughed heartily when I first saw that box, and almost got a scolding from Mr. Chollar for my oral expression of amusement. I would first look at the box and then test the gas. It struck me of course as very amusing. I do not know anything about its principle, but it was laughable to me to watch its operation.

Mr. Chollar—And it works.

Mr. Persons—Yes; it works. The results show that it does.

Mr. Chollar—I have brought a few samples of the oxide here. (Mr. Chollar exhibited a number of samples.) This bottle contains a sample of oxide that has been fouled in the box two or three times. It was going through the revivifying process in the box when the sample was taken out. I take this sample first so that I can get you accustomed to their smells by degrees. I said that when the air was admitted little or no sulphurous oxide was left in the box. That sample was in the box about two months and partly revivified; and the sample I hold in my hand was in about six months and was revivified five or six times. In this sample you will notice a very slight tinge of sulphuretted hydrogen. That has been revivified in the box five or six times. It was put in about the 1st of October. I have only two more glasses here, so that I will only be able to show you two more samples. This sample has been in about six months.

Mr. Persons—From the way it smells I should think it had been in a good deal longer than that. (Laughter.)

Mr. Chollar—We will have some more that are even worse. Here is a sample of oxide that has been fouled without the addition of air at all. I had to go 25 or 30 miles to get it. No air was admitted at all in this oxide. Here is another sample.

The President—In connection with this discussion we might take up No. 2 from the Question Box, which is as follows:

> "Does it make any difference what kind of wood is used for shavings in oxide of iron mixtures; if so, why?"

Mr. Hayward ought to enlighten us on this subject.

Mr. Hayward—I may not be competent to answer that question, for I am identified with the commercial and not with the scientific department of the business, in that I sell oxide and sponge, as you all know. But most of you who have attempted to make oxide likely have encountered difficulties, one of which is referred to in the question now before you, namely, the kind of wood used for sawdust or shavings. Briefly in answer to that question I may say you cannot use oak shavings which contain a form of tannic acid that is very fatal. An oxide should always be in alkaline form and not as an acid or the action will not go on. Another difficulty is that when the oxide remains cold or is not heated up fermentation often begins, an acid is formed, and you wonder why the action does not take place which is expected. It is probably due to this cause of the formation of acid, and I am often asked the question why, in sending out sponge, we use lime. The lime that is first put in does as much work as any lime when it is there, and it always remains as a carbonate or an alkali, keeping the material sweet and clean and preventing this formation of acid. I should answer that question very briefly by saying, "Do not use any oak or poplar or white wood shavings in making oxide; but if you want to keep out of difficulties buy some good oxide." (Laughter and applause.)

Mr. McDonald—If you do not use either oak, poplar or white wood shavings, what kind of shavings can you use?

Mr. Hayward—Pine or spruce shavings will do.

Mr. Lynn—Does Mr. Hayward know what the result at the point of consumption would be, where oak shavings had been used?

Mr. Hayward—No, I have never followed it as far as that. Mr. Chollar might answer that question probably.

Mr. Chollar—If the ammonia in the gas, which is the only alkali to any appreciable quantity, should all be removed, I can see no reason why any kind of shavings could not be used, since there would be no alkali to combine with the acid. But still there might be. I would not make that as a positive statement, because I do not know from actual experiment.

Mr. Hayward—As a matter of fact when the condensers and scrubbers are not efficient the acid is not entirely removed.

Mr. Chollar—That is correct, but I was speaking upon the assumption that it was removed.

Mr. Lynn—Some years ago we had an experience with oxide which contained oak shavings. The shavings had been brought in by mistake along with those of the pine variety, and wherever the gas which had passed throgh the oxide containing the oak shavings was used it burned in a sputtering sort of manner, and we had to replace a large number of globes which had been broken in residences. When we threw that oxide away we had no more difficulty of the kind at all, so that the use of the oak shavings must certainly have affected the gas.

Mr. Printz—Mr. Hayward speaks of pine, and there are several kinds of pine. Is there any objection to the use of Norway or pitch pine?

Mr. Hayward—The main objection to the use of that is its brittleness. Pitch pine breaks up in powdered form, much more so than the regular white pine shavings.

Mr. Seamon—Regarding the question raised by Mr. Lynn, with reference to the use of the oxide as affecting the gas at the burners, we changed from purification by lime to oxide about four years ago. We made our own oxide, using in it about 25 or 30 per cent. oak shavings, and after a period of about four or five days a carbonized substance seemed to form on the lava tips around town. We had to change many of them. This carbonizing lasted for about two weeks, after which time we had no further difficulty, though we continued to use the same oxide. The new oxide, however, seemed to affect the gas at the point of consumption in the way I have indicated.

Mr. Doherty—I would like to report something that may be a trifle outside the lines of the paper, but which I think will interest the members. During January I had charge of a gas plant with a very large purifying house. I have been advocating for some time that in new buildings the purifiers should be put out doors. I do not think it is necessary to house them. I learned one day that the temperature in the purifying house was far too low to insure proper purification. I had discussed this matter of putting the purifiers out doors, but the superintendent of the plant disagreed with me. I pointed out that if they were put out doors and were properly protected it would be just as easy to maintain a proper temperature out doors as it would be in a purifying house. In the one case you have the boxes covered by the walls and the roof, and an immense intervening air space, and in the other case you have them covered close with wood or some other good non-conductor of heat. When I found the temperature was so low in the purifying house I called his attention to it, and he said, "You do not expect me to keep up the temperature in that great, big barn, do you?" I said, "Well, can't you do it?" He said, "No, it is impossible. I will tell you what we might do though; we might put non-conducting material over these boxes and then they would be all right." (Laughter.) I do not think purifying houses are necessary. Mr. Donald McDonald in running his plant has his purifiers out doors. Regardless of climate, and having in mind any kind of climatic changes to which we are liable in the United States, I would not advocate the housing of purifying boxes. Using purifying boxes that do not require a water seal, I would cover them with some non-conducting material, and thus save a good deal in the installing of my purifying system.

Mr. Stone—Regarding this matter of the stoppage of burners caused by oak shavings in purifying material, I think the trouble is not merely with the oak shavings, but that the stoppages are chargeable to the iron not being thoroughly rusted. I had trouble of the kind to which the gentleman refers, but that trouble came when I was using oxide mixed with pine shavings. I removed the oxide and thoroughly rusted it, spending about three weeks in getting it in shape. After putting it back in the boxes I had no further trouble so far as the stoppage of the burners was concerned. I think when you have free iron in your oxide you will have burner stoppages.

Mr. Lynn—I do not think the iron is so apt to cling to hard wood

such as oak as it would to soft wood like pine, and I still am under the impression that the oak shavings caused our trouble.

Mr. Hayward—I think perhaps the subject of burner stoppages has been pretty well threshed over in other associations and is pretty well understood by gas men. It has nothing to do with the use of oak or any other kind of shavings, but is due solely and entirely to the free metallic iron. I think a series of experiments have demonstrated that such stoppages are caused by carbonyl of iron, a sort of compound carried forward by the gas in contact with the iron, and it may not always be in purifying material. In one case where I sold a lot of oxide there was a good deal of complaint on account of burner stoppages, and the oxide was charged with being the offender. Investigation showed that the company had laid some 13 or 14 miles of new mains and tapped in services all the way. At every tapped place were more or less borings dropped into the mains, forming nice little piles of unoxidized iron. The gas coming in contact with this iron carbonyl compound it was carried forward and formed what the boys sometimes call "Christmas trees" on the burner tips. The stoppages were due to that fact and not to the purifying material at all. But, as you all know, the process of making iron oxide must be carefully and well done; you cannot do it in a day or two. If you do you burn up your sawdust, but ordinarily, by constant burning and exposure, you can, in the course of from three to six weeks, get it thoroughly and well oxidized. If you do not you will have the trouble of burner stoppages as certain as the world. That has been demonstrated over and over again. And if it does occur, as has been instanced here, after a course of two or three changes, and oxidation has taken place to the point of thoroughness, no further trouble with burner stoppages is experienced. One remedy for it is to put in the last box on the top layer any kind of a close filter—no matter whether it is lime or clay or anything that will filter or prevent the iron carbonyl being carried forward with the gas; and as a precaution in using new oxide I would always put in your last box 3 or 4 inches of lime, more as a filter than anything else. It does no harm there as you know. I simply offer that as a suggestion.

Mr. Light—One of the best ways in employing oxide is to so arrange that you never have to use new material. Put the new oxide in the first box, leaving the last two boxes of old oxide to catch anything of that kind which may be found. Heretofore we experienced some of the trouble to which the gentlemen have referred, but since we have adopted the plan I suggest we have had no further difficulty with it whatever.

Mr. Hayward—Mr. Light, sometimes they are fixed so they cannot do that.

Mr. Light—Yes; but if they are situated so it can be done that is a remedy.

Mr. Hayward—I know of cases where in a series of fours they put in an extra box, using a last box of old oxide which does not have to be changed. I am not chemist enough to know just what the action is, but I have been told that the old oxide will absorb some of the sulphurous compounds which the newer oxide will not absorb, like bisulphide of carbon. That box need not be changed, but may remain for five or six changes. That will remedy the difficulty of these burner stoppages as well as the filter. But of course you are not all fixed with that extra box for use in the way I have suggested. Regarding the practice advocated by Mr. Chollar of reversing, I would like to confirm it by saying that many gas works have been using oxide when they have absorbed in it as much as 65 per cent. of sulphur and yet not have it thrown down or carried forward. That would seem to confirm the statement that there is no possibility of any chance, when you are using old oxide and the gas passes through it last, of sulphur being thrown down.

Mr. McDonald—It seems to me inconceivable that the small amount of tannic acid in the oak shavings would neutralize the ammonia in a large quantity of gas. Generally speaking, you have to take the kind of shavings and sawdust that the sawmills can give you. In a great many places oak is intermingled with something else. If anybody here can speak positively on the subject I would be very much obliged to have them express themselves, because this is a matter we should all know about, for at times and in some localities it is very difficult to procure shavings and sawdust not containing oak.

Mr. Cline—Mr. Lynn has just given his testimony on the subject.

Mr. McDonald—Yes; and Mr. Lynn also said it was with new oxide that he used the oak shavings, and he did not know whether the trouble came from the oak shavings or the new oxide.

Mr. Butterworth—We have used oak sawdust for the last year in mixing oxide and have had no trouble whatever that I know by reason of such use. We have used oak sawdust for several years past, and ran the boxes for three months without change.

Mr. Lynn—What effect, if any, would the placing of purifiers outside of buildings have upon registration?

Mr. McDonald—I presume if the gas got cold it would not have as great an effect on the meter. But there is nothing to keep it from getting warm. It seems to get just as cold in the holder as it would be in the purifier.

On motion of Mr. Andrews a vote of thanks was tendered to Mr. Chollar for his valuable paper.

The President—The last paper upon the programme is that by Mr. Peter Young, of Detroit, Mich., who unfortunately is not able to be present at the meeting. If there is no objection the Secretary will read it.

The Secretary then read Mr. Young's paper on the subject of

BY-PRODUCT COKE OVENS AS A SOURCE OF GAS SUPPLY.

Fulton, in his "Treatise on Coke," makes the following statements in relation to retort and by product coke ovens:

"The efforts for supplementing the profits of coke making, by saving the by-products of tar and ammonia from the gases discharged from the coke ovens, occupied the early attention of coke manufacturers.

"Evidently this new departure was suggested to coke makers and oven builders from the operations in the manufacture of illuminating gas; the gas makers, in the process of purifying this product, required the elimination of tar and ammoniacal water.

"It thus became evident to coke makers that the gases evolved from the coke ovens contained similar products, and logically suggested additional profit in saving them.

"It is recorded that the first coke ovens producing tar and ammonia as by-products were constructed at Sulzbach, near Saarbrucken, in 1796. These first attempts were very crude and of little practical value.

"Very slow progress was made in the saving of by-products; their practical manufacture and sale in market were not assured until about 1883.

"The reason of this slow progress has been attributed to two principal causes; the low price of these products in market, from the supply of the gas works, under the method in use until recently, of making illuminating gas from bituminous coal; besides, the early efforts at the coke works were expensive and unsatisfactory, both in quality of coke and value of by products secured.

"The principal difficulty in extending the use of these ovens, and which has only recently been corrected, consisted in the neglect of proportioning the several parts of the oven to the requirements of the quality of the coals to be coked.

"With the advent of correct dimensions in the retort coke ovens, to meet the wants of the various qualities of coal, their increased use in the manufacture of coke and saving of by products has been largely extended.

"At one plant in France the surplus gas, after the extraction of by-products, is used for illuminating purposes. The temperature obtained in this oven is fully equal to the Otto Hoffman oven, with its expensive regenerators.

"In the United States of America, with its great coal fields, embracing so large areas of excellent coking coals, the introduction of retort coke ovens has been slow. This arises mainly from the large cost of these ovens, especially when supplied with an equipment for saving by-products.

"A secondary hindrance consists in the expensive labor cost in small experimental plants. A maximum number of coke ovens are required to assure minimum cost in the labor of coke making. However, since the decline of the production of tar and ammoniacal liquor in the gas works, the by-products from coke works have realized a revival of their importance, especially the sulphate of ammonia, as a valuable farm manure, which, in the progress of improved agricultural operations, is coming largely into demand.

"These have given retort coke ovens renewed attention and importance. This will be further reinforced as the use of coke enlarges, requiring the use of some of the secondary qualities of coal to maintain the necessary supply of this valuable metallurgical fuel."

It will be seen from the above quotations that by-product or retort ovens have been used for the manufacture of coke about as long a period as gas has been used as a means of furnishing light, and yet coal gas, in the most of cases, is still made in retorts and in plants designed to make gas as the principal product and not as a by-product.

Notwithstanding the fact that there are at least a dozen or more retort coke oven plants on the American continent, there are only two of them supplying illuminating gas to the public—one in Halifax, Nova Scotia, the other in Boston, Mass. And it is a question whether, under all conditions, these plants can be operated as gas producing plants as economically and efficiently as a well equipped works. with either inclined or horizontal retorts and proper coal handling machinery. There are certain localities where no doubt the coke oven can be made to produce gas as a by product, but it is only in localities where coke is now being produced in beehive ovens at a profit, as coke can be produced in a retort oven at a less cost than in a beehive oven as long as the present price for residuals can be obtained.

We will now compare the costs of two plants capable of producing for sale 500,000 cubic feet of 16 candle power coal gas per day, one a by-product oven plant, the other with horizontal retorts set over recuperative furnaces. We take 500,000 cubic feet as a basis, as the minimum number of ovens that can be operated profitably is 25, so say the parties operating them, and as shown later there will be 500,000 candle power of surplus gas from that number of ovens if properly operated.

Oven Plant.		*Retort Plant.*	
25 Ovens $3,000 each.....	$75,000	10 benches (6) complete...	$13,000
Hydraulic main and connections.....	5,000	Exhausters.....	1,700
Pusher.....	2,500	Tar extractor.....	650
Exhausters	2,250	Condenser	1,800
Tar extractor.....	900	Scrubbers.....	3,000
Condenser.....	2,000	Purifiers	12,000
Scrubber.....	3,500		$32,150
Purifiers	12,000		
	$103,150		

To these amounts must be added the cost of buildings, which would be about the same in both plants. In the coke oven plant it will also be necessary to have coal handling machinery, but in a plant handling only 50 tons per day, as in the retort plant, would machinery not be economical?

The amounts of coal carbonized per bench and per oven are identical, and the gross results obtained are nearly so, the only difference being that from 2 to 4 per cent. more coke of a better quality for certain purposes is obtained from the oven, and a better quality of gas from the retorts; but as the ovens are heated with a portion of the gas, and the retorts with a portion of the coke produced, the net results obtained are not the same.

The products for sale obtained from 2,000 pounds of coal of good quality, if the ovens are operated on 60 per cent. of the gas produced, and the retorts on 25 per cent. of the coke produced, would be as follows:

By-Product Ovens.		*Retorts.*	
Coke.....	1,400 lbs.	Coke.....	990 lbs.
Tar	11 gals.	Tar	11 gals.
Ammonia	5 lbs.	Ammonia	5 lbs.
Gas, 16 candle power..	4,000 cu. ft.	Gas, 16 candle power.	10,000 cu. ft.

Each individual must judge for himself the value of the above products in his own locality, and in calculating the results it must be borne in mind that the demand for coke must be practically the maximum production of all the ovens run to their full capacity, 365 days each year, or, as a coke producing plant, it will not be a commercial success. It will be seen from this that the quantity of gas produced will also be constant, and the problem then presents itself whether to build the plant large enough to supply only the minimum consumption, and take care of the variations, either with a water gas plant or retorts, or to build the plant large enough to supply the maximum demand and utilize the surplus when the demand is not equal to the production for firing boilers, etc.

Although the demand for gas has nearly always been on the increase, no mattter what the state of trade is with other manufacturing concerns, such is not the case with coke; the amount of manufacturing, the severity of the winter and like causes all have a very marked influence on the price and demand for coke, and the question arises, "Will it pay better to go into the coke business, to sell gas, or stay in the gas business and sell coke?" Where a steady demand for oven coke can be created at a figure above the price of gas works coke enough to justify the investment in coke ovens, then it will be a judicious investment, but in nearly all localities, gas works or retort coke brings as high a price for domestic use as oven coke.

The claim is made that the saving in labor in a coke oven plant reduces the cost of the gas. Thirty cents per ton of coal is about the average for all labor connected with the manufacture of coke in a by-product oven plant.

The writer has been informed that a contract was made recently for a stack of inclined retorts, in which the erectors guarantee to take the coal from cars on railroad siding, and return coke to cars for 18 cents per ton of coal carbonized. Add to the above the amount necessary for purification and other labor employed at the plant, and it compares very favorably with the cost of labor in the oven plant. Another point of economy claimed is in the use of slack. There are several gas plants where slack is used, and no difficulty is found in marketing the coke.

The 10 ovens at the plant of the Peoples Heat and Light Company, Halifax, Nova Scotia, are fitted with two hydraulic mains, also two separate condensing and scrubbing plants. The first distillations are taken into one hydraulic main, then to the condensing and scrubbing apparatus and through a set of purifiers, and sold for illuminating purposes. The balance is taken into the other hydraulic main and through another set of condensers and scrubbers and burned under the oven. Operating in this manner, about 4,000 cubic feet of 17 to 19 candle power gas per ton of coal is obtained. In a small plant the same results can be obtained with a single set of condensing and scrubbing apparatus, by charging the ovens as rapidly as possible and taking the first portion of gas made; but in this method it would be necessary to have two holders, one for the illuminating gas and another for the fuel gas. And it must be borne in mind that to supply 500,000 cubic feet of gas to the consumer it is necessary to carbonize 125 tons of coal in an oven plant, whereas in a retort plant it would only be necessary to carbonize 50 tons. A market must be found for 87½ tons of coke in the one case, and in the other 24⅝ tons; and as it is often a difficult matter to dispose of the smaller quantities of coke produced in a gas works the difficulty would increase for the greater production.

In Halifax it was found necessary to erect benches to supply the amount of gas over and above that produced in the oven. Producers were also erected to fire the ovens, in order that the total quantity of gas produced could be sold, but were found unprofitable, as the quality of the total quantity of gas produced is such that enriching to the proper standard required over 2 gallons of oil per 1,000 cubic feet of gas.

In the case of the New England Gas and Coke Company the conditions are different. The demand for gas is equal to the production, as I understand that a contract has been made with several gas companies to take the surplus gas at 20 cents per 1,000 cubic feet in their holders, candle power to be not less than 14, and as the production is not equal to the demand of these several companies the plant can be operated to its full capacity and the gas disposed of at a good price.

The demand for coke is so great at the present time that there are no ovens of any kind in the country that are not in use, and coke in some districts is being made without ovens. Gas works coke is also in good demand. This of course makes it possible to obtain prices beyond the average, and the New England Gas and Coke Company, I understand, have made contracts for a term of years at the high prices now prevailing. Their coal is low in cost, and the locality and conditions are favorable for making a steady demand for coke to replace anthracite coal, which is expensive and of which large quantities have been used. As coke producers for metallurgical or other purposes retort ovens are a success, when operated strictly as coke ovens, as has been demonstrated at numerous plants in Europe, and also in this country, at Syracuse, Sharon, Dunbar, Ensley, Wheeling, Johnstown, Glassport, etc.; but as they are constructed at the present time they cannot compete with retorts as a source of gas supply, as it takes 60 per cent. of the gas produced, which is the most valuable product, to do the work that is done with 25 per cent. of the coke produced, which, under ordinary conditions, may be valued at about $6 for the gas and $1 for the coke.

Another defect in coke oven plants is lack of elasticity. The whole plant must be operated to make it profitable, and if producers, holders, or other expensive apparatus are added to give this elasticity, it adds to first cost and also to operating expense.

Owing to press of business, the writer has been unable to devote the time to this subject that it warrants, but if these few disconnected thoughts afford a basis for a thorough discussion of the "By-Product Oven as a Source of Gas Supply," the object of the paper will be accomplished.

Discussion.

The President—It is indeed unfortunate that Mr. Young is not here to assist in the discussion of his interesting paper. I hope the gentlemen who are present will discuss it as fully as they possibly can. Mr. Lynn, can you start the discussion?

Mr. Lynn—The paper possesses a peculiar value to us from the fact that it comes from one of our members who speaks from actual experi-

ence. Mr. Young is one of the very few members in this Association who has had any experience with by-product coke ovens, and he is certainly capable of supporting anything set forth in the paper. One point to which I would like to call attention is that in the plant, as suggested by him, the interest on the increased investment alone would amount to $11 per day, which of course would be placed against the cost of gas. Furthermore, figuring on a basis of $2 per ton for coke produced, which is a little higher than the average price obtained at the oven for metallurgical coke, we find in the by-product ovens the revenue derived from a ton of coal would be $7.54, while from the retort we would derive a revenue of $12.72. But based upon the fact that in a by-product oven we consume 2½ times as much coal, the revenue per day from the coke ovens would be higher than it would be from the retort. The basis of 500,000 cubic feet per day I presume was taken from the fact that Mr. Young was probably under the impression that with a plant of smaller capacity it would be useless altogether to attempt the use of by-product ovens in the production of gas. Metallurgical coke as a general thing at the coke ovens brings from $1.56 to $1.75 per ton. The average for the gas coke I should judge was considerably over that amount, and when the comparison is made between gas coke and coke oven coke—the majority of it is shipped around through the country—the gas coke has considerably the better of it. If all the gas were preserved for sale and the solid fuel used under the oven, as Mr. Young says, the cost of enriching would be another item which would amount to considerable. I do not think the ovens could be substituted at all for anything except in moderately large plants.

Mr. Butterworth—The owners of the Columbus Gas Company properties are looking forward to the time when they shall erect by-product coke ovens in Columbus. That is the present intention of the management. If natural gas should fail or decrease materially in quantity, the present intention is that they shall erect a by-product plant, although their minds may be changed by existing conditions when that time comes. We will govern ourselves by the conditions which exist at the time. I have been corresponding with the New England Gas and Coke Company and have had several very interesting letters from the Manager. I visited the plant myself and spent a very pleasant and profitable day there. As far as I can see and learn they are evidently doing splendidly and their prospects are exceedingly bright. I think the conditions existing with them are exceedingly favorable for such an enterprise. They are making 1,500 tons of coke per day, and have sold it in advance without any difficulty, and could sell a great deal more; in fact, they are preparing to make more. In supplying two or three of the Boston gas companies, they are supplying a great per cent. of the gas used in the city of Boston now very satisfactorily. They are making 18-candle gas and saving as their surplus for that purpose about 35 per cent. of the total production of gas. I understand it will probably be necessary to build producers to maintain the temperature of the ovens in extremely cold weather, and enable a larger percentage of the production of gas to be used in supplying the demand at times of sudden demand and of high consumption. But the Manager assures me, and I believe he is sincere, that their prospects are exceedingly bright and they are very much gratified at the outlook. In Columbus we may be rather favorably situated for operating a works of this character. We have already one large blast furnace and steel plant consuming a great quantity of coke every day, and another plant of the same character in the process of erection. We have here a large local demand for coke, and even if that demand should fail we are reasonably close to Chicago where there is always a large demand. We, therefore, feel that we can venture upon the enterprise with reasonable hope of success. It is our present intention to do so, although when the time comes we may find there is something better.

Mr. Lynn—Under the conditions prevailing at Columbus, with the consumption which I think the Columbus Gas Company has, it might be possible to substitute the coke oven and make a success of it, but if it can it is the smallest plant in Ohio that can do it. I do not know what the difference between the maximum and minimum daily output in Columbus would be, but in the summer time even there it might be found that the coke ovens were more expensive than the retort system.

On motion of Mr. Butterworth a vote of thanks to Mr. Young for the very interesting paper which he forwarded, with an expression of regret over his absence, was adopted.

The President—The next order of business is the reports of committees.

The Secretary read the following

REPORT OF COMMITTEE ON NEXT PLACE OF MEETING.

Your Committee on Next Place of Meeting, having received an invitation from the Dayton Gas Light and Coke Company to hold the next meeting of the Association at Dayton, recommend that the invitation be accepted

GEORGE LIGHT,
J. W. R. CLINE,
E. E. EYSENBACH, } Committee.

On motion of Mr. Andrews the report was unanimously adopted, and the President so announced.

Mr. Fred. R. Persons read the following

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

COLUMBUS, OHIO, March 22, 1900.

The committee to whom your President's address was referred beg leave to present this minority report as follows: The chairman of the committee having decamped, makes it imperative that this report come from a minority.

The members of this Association are very much pleased with this address on account of the recommendations made and the concise and businesslike manner in which it is written.

The untiring and unceasing efforts of your Secretary deserve the pleasing notice given, and your committee wish to add that we have no Secretary to trade with any other Association, even if a big cash bonus were to accompany the offer.

The recommendation that "Buildings on existing lines in which no gas is used be piped, etc.," we cheerfully recommend to the Association as the best means of building up a permanent consumption.

We recommend that a committee of one be appointed to confer with the electrical associations in connection with the subject of municipal ownership, and that the vigorous co-operation of this Association be pledged this committee in his efforts, and that he make suitable report at our next meeting.

The recommendation regarding the report of the Municipal Code Commission bill is well taken, and the bill should be familiar to every member.

The recommendation regarding the membership committee should be taken up at the executive session, and a resolution offered tending to the appointment of such committee, and possibly laying out a line of campaign so that we may be enabled to reach every gas works in the State. It is also recommended that a suitable vote of thanks be returned to the President for the interest shown in the meeting and for the masterly way in which he presided over it.

Respectfully submitted,

F. R. PERSONS,
J. H. MAXON,
G. A. ALLEN, } Committee.

On motion of Mr. Whysall the report of the committee was adopted.

Mr. Eugene Printz then submitted the following

REPORT OF COMMITTEE ON MEMORIALS.

COLUMBUS, OHIO, March 22, 1900.

To the Ohio Gas Light Association: Gentlemen—Your committee on memorials report that since our last meeting we have lost by death Mr. William Weeks Prichard, who passed away, after a short sickness of Bright's desease, at his residence in Portsmouth, O., Sept. 29, 1899.

Mr. Prichard was born in Granville, Licking county, O., August 27th, 1845. In 1867 he married Miss Olive W. Channell, who survives him, and to whom were born 10 children.

Mr. Prichard was made Manager of the gas works at Ironton, O., in 1885, and came to Portsmouth to superintend the works of the Portsmouth (Ohio) Gas and Electric Company, in 1892, which position he filled until the time of his death. He was a charter member of this Association, and a regular attendant upon the meetings, having been present at every meeting and showed great interest in the welfare of the Association. He was highly esteemed by all the members for what he truly was, an honorable, painstaking and just person. He was and Episcopalian and vestryman of All Saints Protestant Episcopal church at the time of his death. The chairman of this committee was closely associated with Mr. Prichard ever since he came to Portsmouth, both in his work with and for the Portsmouth Gas and Electric Company and his church work, and saw much of him during his last sickness. His end was peaceful. His example is worthy of imitation. This Association loses a much honored member.

Mr. A. H. Johnson died December 5th, 1899, at Salido, Col., as the result of a railroad accident. He lived in Oberlin for 50 years and was one of Oberlin's most honored citizens. He was identified with the College of that town, and as a Bank President and President of the Gas Company, and held the esteem of all persons with whom he came in contact. He was a man of retiring disposition and therefore not well known among the members of this Association. Those who did know

him appreciated him for his real worth. We have lost by his death a member whose real worth cannot well be replaced. We recommend that the Secretary spread this report on the minutes of this meeting.

E. B. KEHOE, Chairman,
EUGENE PRINTZ,
JEROME PENN,
} Committee.

On motion of Mr. Cline, the report was adopted and ordered spread upon the minutes of the Association.

THE QUESTION BOX.

The President—The next order of business will be the Question Box. Question No. 3 is:

"Does it pay to rent gas stoves?"

As that subject was pretty well covered in the discussion of the paper on "Gas Appliance Exchanges," we will, therefore, pass to the 4th question, which is

"Would it be practical to use the heat from oven in retort house to apply to Yaryan system of hot water heating?"

I will call upon Mr. Doherty.

Mr. Doherty—I am considerably interested in this subject. I think the man who wrote it had an eye to business. I made some rough figures here yesterday intending to use them in the discussion of this question, but seem to have mislaid them. I will, therefore, try to give them from memory. The Yaryan system of hot water heating—I do not know whether everybody in this room is familiar with it or not—is an arrangement for utilizing the exhausted steam from electric light plants, and that passes through a tank and heats water and a circulating pump sends the water through the streets and into the houses and back. The thermal capacity of water or range that they could use would probably not be much more than 100 British thermal units per pound, while with steam they could get 1,100 per pound. But the thermal capacities of steam and water in quantity are more nearly alike. Whether we could use the heat from our benches for hot water heating would be a matter to be determined locally. But here are some figures that would perhaps help us in determining it. A ton of fuel burned in the furnace of a bench would give from 13 to 20 tons of waste gases, or from 320,000 to 500,000 cubic feet. I do not think in any case that it would throw off those gases at less than 800°, and at 800° it would be equivalent to the burning of from 300 to 500 pounds of coal. Suppose that each bench uses 1,500 pounds of fuel in the furnace. Then we could figure that for every bench we would have an equivalent of 300 pounds of coal in a 24-hour day. Another advantage of heating from a gas works instead of electric light plants is in the fact that the latter have very irregular loads, and at the same time when the heat is least needed they generally have the most to sell. They want the heat most early in the morning, and a gas works of course would have practically a constant load all day. The thermal capacity of the waste products of combustion I think is .24 per pound against water as unity, so anybody can figure for themselves on that line. This illustrates not only how we might use this waste heat, but it also demonstrates the fact that our fuel economy is not as high as it should be, and by further recuperation we could greatly reduce the amount of coal necessary for carbonization. A serious matter that should be considered in looking at this question is the efficiency of a given amount of heating surface. You have not got all combustion and you have practically no radiant heat, and you will find where a single foot is capable of absorbing a given amount of heat in a boiler furnace, it will take many times that to absorb it from practically dead gases, and that would be about the figure, with a boiler of immense capacity, to do the same amount of heating that we now do with a very small boiler. I am inclined to think it would be more feasible to bring the water in direct contact with the gases, similar to the way it is done in an instantaneous water heater. Let the gases move up and the water move down, coming in direct contact with each other, which would cause very cheap installation. I would like to see this worked up, and favor the idea that the Association appoint a committee to report through the press, not waiting until the next meeting of this Association.

Mr. McDonald—Assuming that you have a given amount of hot water, what revenue could you get by selling it?

Mr. Doherty—If you have a commodity to sell which the people have to provide by another method, it is reasonable to suppose you could get practically as much as it will cost them to heat their houses now by a furnace; and I think you can get that much if not more. It does not necessarily follow that you have to use the Yaryan system for distribution. You can use steam if you want to. I do not think the Yaryan system covers everything that must be done in the way of distribution of water for heating houses. But any of the members of this Association can get from the files of the electrical journals the plants that are now using the heating system, and they are found more or less on record in the various journals on this subject. In the proceedings of the last meeting of the Northwestern Electric Association you will find a paper by Mr. Shauck of Illinois. That Association at each meeting for the last three years has considered this question, and I think it is worth our while to look into the subject. I am sorry I have not the figures with me which I made yesterday. I brought down a book this morning from which I expected to make up another list of figures to be presented to you when this subject was called up, but the question came so quickly that I have not had an opportunity to finish them.

Mr. Andrews—Regarding the question of Mr. McDonald as to what you could get for heating a house, I understand that at Toledo, O., the cost of heating an ordinary sized house averages about $80 a year.

Mr. McDonald—My thought was that in every plant an enormous amount of heat is produced. I suppose on an average the coal burned for manufacturing purposes does not produce usefully more than 10 per cent. of its ultimate heating capacity, the balance escaping as "hot" products of combustion. Now, a market for heat below the boiling point of water is something that people have been looking for a long time, and the gas works haven't any more of that kind of heat than iron foundries, forging works or 100 other establishments using steam and fuel and producing heat. It appears to me the difficulty is in maintaining a circulation through the streets and selling the large volume of hot water that would be required for domestic heating. Recently I saw that some one patented a device to allow the exhaust steam, which is about the lowest form of heat we get, to evaporate sulphurous acid, using the vapor of sulphurous acid for useful work in a large cylindered engine. If that is practical there is a market for your low heat.

Mr. Doherty—The arrangement you speak of is simply a different medium for securing similar results. Ever since I studied steam engineering I found in all of the text books reference to attempts to do just what you now indicate, but all of them have proved unsuccessful; in fact, impracticable. So far as the Yaryan system is concerned, it is in successful operation, and a good many electric light companies are getting back more than the cost of their coal from the waste heat of their steam. About 10 per cent, you say, is used. Then, 90 per cent. of it is available for some such purpose as has been indicated, but that 90 per cent. in an average electric plant does not amount to a great deal; but when you say these other establishments have as much at their disposal as a gas works, I will have to disagree with you, because they do not burn as much fuel, and they do not burn it 24 hours a day. A gas works does; and an iron foundry is generally badly located. Iron foundries, forging concerns and the like of these industrial plants are generally badly located. They are liable to be shut down two months in the winter time. We do not. We run 24 hours a day, every day in the year. If the Yaryan system is susceptible of utilization, or if it has proved perfectly practical in electric light plants, I see no reason why it cannot be made equally practical in a gas works so located that they can distribute this heat to houses. I do not know of any way where we can get better results, measured by British thermal units, for heating purposes than to distribute it in the form where it is ready for use in the house for hot water heating. After it gets in the house you have 100 per cent. efficiency. I do not want to cut off the discussion, because I think it very interesting, but if discussion upon this subject is at an end I move that a committee be appointed to report the result of an investigation on this subject through the press. (Seconded by Mr. Hayward and adopted.)

The President appointed as such committee Messrs. H. L. Doherty, G. N. Clapp and Donald McDonald—Louisville, Ky.

The President—If nothing further is to be said on the subject, we will take up Questions 5, 6 and 7, which may be discussed jointly:

5. "What is the maximum speed at which it is safe to run a station meter drum; the speed being measure in lineal feet traveled by the perimeter of the drum?"
6. "Is this constant for all sizes of station meters?"
7. "What limits the speed of the drum of the station meter?"

I will call upon Mr. W. S. Gribbel to answer these three interrogators.

Mr. W. S. Gribbel—Answering question No. 5, without taking up the time of the Association by going into details, but responding to the query as briefly as possible, I will say that the maximum speed at which it is safe to run a station meter, the speed being measured in lineal feet traveled by the perimeter of the drum, is the highest speed

at which accurate registration is assured. I would answer No. 6 affirmatively, by saying that it is constant for all sizes of station meters. I would answer No. 7, as to what limits the speed of the drum of the station meter, by saying that it is limited by pressure, volume and resistance.

The President—Questions 8 and 9 have already been discussed. Question No. 10 is as follows:

10. "How much steam is required to make 1,000 feet of water gas?"

Mr. McDonald, can you answer the question?

Mr. McDonald—I would very much like to hear that question answered by somebody who knows.

Mr. Andrews—I believe a paper[1] was published in one of the GAS JOURNALS within the last six months on this very point, a paper read before the American Gas Light Association. If you will look back among the files of your GAS LIGHT JOURNAL, I think you will find the question answered in full.

Mr. Doherty—Do you mean Mr. Miller's paper?

Mr. Andrews—Yes; does not that cover it?

Mr. Doherty—No; I do not think it does.

The President—Question No. 11 is as follows:

11. "If tar is sold by the gallon, without specifying what shall constitute a gallon, shall it be determined by volume or by weight?"

I suppose that is largely a matter of contract to be decided between the buyer and seller.

No. 12. "How many cubic feet does a ton of ¾ gas coal occupy?"

Can Mr. McDonald answer that question?

Mr. McDonald—I do not know what ¾ gas coal is.

Mr. Andrews—It refers to coal with a ¾ screen.

The President—I suppose that question would depend altogether upon how long the coal had been stored, with other conditions.

Mr. Doherty—Let me give you a little history connected with that question, as I asked it myself. I have always used 36.4 feet in estimating the quantity of coal in a given pile. Recently a controversy arose, with which some of you are familiar, as to the quantity of coal in a certain shed, and I found that others were using figures varying all the way from 30.4 to 56. I thought my figures were right, so we called in two coal men who gave us two different figures. Then we measured three car loads, and, according to the measurement returned, about 50 cubic feet were required for a ton of ¾-inch Youghiogheny gas coal. Being sure that was too much, I thought, by asking the question at this meeting, I could discover someone who, having experience on the subject, would name to us the proper figure.

Mr. McDonald—I use 1.6 cubic foot per bushel or 40 cubic feet per ton, which is the rating the Louisville and Nashville Railroad Company practiced when I worked for that corporation in the measured weighing of its coal. How close the actual weights come to that I cannot say. A matter to be considered in determining the number of cubic feet occupied by a given weight of coal is as to the varying sizes of the coal. When large and small lumps are mixed together the smaller will be the voids. In coal all of one size the voids will make up one-half its volume; but if the sizes are large and small there will be a much smaller proportion of voids. In other words, as it is a matter varying with differing sizes of coal and under different conditions, it would be difficult to name a figure answering all instances.

Mr. Doherty—The question was intended to embrace that feature of the subject by specifying ¾ gas coal.

Mr. Andrews—The figures generally used are 28 bushels to a ton of Youghiogheny coal in the Cincinnati market, which figures out between 1.4 and 1.6 as Mr. McDonald stated. In speaking the other day to a man, connected with a large concern, who has had much experience on this subject, he said he figured on a basis of 45 feet for bituminous storage capacity and 37 feet for anthracite, and found these figures were not far out of the way.

The President—Question No. 13 is:

"Does it pay to screen breeze to recover the salable coke mixed with it?"

Mr. Andrews—Using a revolving screen I should say it would, because you can take a screen of ⅜ mesh, run the coke over it and reduce the breeze to a very small amount, thus saving a large amount of pea coke product, which otherwise would be wasted. A very ready sale can be found for it for use in forgings, at practically as good a price as ordinary lump or nut coke. Without a revolving screen it will not be worth your while, the screen choking to such an extent that you can not get satisfactory results.

The President—Question 14 is:

"What does it cost per ton to crush coke?"

Mr. Andrews—The main cost is the percentage of breeze made in crushing it, for the labor is a very small item. In different crushers it would run all the way from 5 to 15 per cent. of the amount of coke crushed. I have never seen it much lower than 5. Ten is about the average of the ordinary crusher, but in some instances it runs as high as 15 per cent.

The President—Question No. 15 is:

"Should we not adopt standard names for uniform sizes of coke and endeavor to fix some standard size for various sizes of coke, such as is done for fixing the size of stone used in concrete work?"

Mr. Andrews, can you answer that question?

Mr. Andrews—I do not want to take all your time in attempting to answer these questions, but since I have been called upon I will say that the usual sizes adopted are screens from ⅜ to ½ for pea coke, and from ½ to 1¼ inches for nut, and from 1¼ inches up to whatever figure you may desire for what we call egg-sized coke. As a general thing, it runs up to and includes anything which would go through a 3 inch mesh.

The President—Question No. 16 is:

"Is it a good scheme to make a distribution of natural gas by means of a holder and governor?"

I will call upon Mr. Whysall to answer that question.

Mr. Whysall—I do not see any particular advantage that would accrue by the use of a holder, only to the extent of having the gas on hand which the holder would contain. Natural gas companies depend entirely upon the storage of the gas in the line, which is a very considerable quantity. With a short line there would be no advantage whatever in having a holder, while on a very long line a holder would be an advantage. You could fill the holder in the warm days when the demand was not very great, and during the time of greatest demand you could turn it loose.

The President—Question No. 18 is:

"Should a gas company attempt to regulate or control the use of incandescent gas lights? In this case, what attitude should be taken toward the cheap lights sold by department stores?"

Will Mr. Olds answer that question?

Mr. Olds—As we do not have any trouble with cheap lights in our city I have nothing to say on the subject.

The President—Does anyone have any trouble with them? (No response.) If there is nothing further to be said upon this subject, we will take up the next question. Question No. 19 is:

"Has any member found a successful method of fighting the introduction of gasoline or vapor incandescent gas lights?"

The Secretary—I do not think vapor or gasoline incandescent lights are serious competitors, because of the high prices of gasoline and the trouble of caring for them. I should not think it a serious matter at all. I have never had any trouble. Some have been introduced, but they have been discarded for the reasons named.

The President—Question No. 20 is:

"What are the latest developements of the incandescent gas burner?"

Mr. Whysall, can you answer that question?

Mr. Whysall—The self-lighting attachment which was shown in the corridor of the hotel I think is about the latest development.

Mr. McDonald—Has any member seen the Kern light?

Mr. Whysall—I saw the Kern light about a year ago. It was exhibited by a party who went through this section of the country making tests. The tests I saw were made with natural gas and the results were very good. He said the results were equally good with coal gas. A remarkable feature about the light was the fact that the variation, or rather the increase, in pressure did not cut down the light or the candle power. On the other hand, it seemed to increase it to a certain point.

Mr. McDonald—I have never been able to see anything in the Kern light except the peculiar shaped burner, and I cannot believe it produces such enormous results as the promoters claim for it. I would like to hear from anyone who knows something about it.

Mr. Whysall—The Kern burner appears to secure a more intimate mixture of gas and air. That is all I can see in it. It possibly does increase the velocity of the mixture and in that way drives it up into the mantle.

1. See JOURNAL, Oct 23, 1899, p. 652: "The Steam Consumption in a Water Gas Plant."

The President—Mr. Doherty, we are now back to Question No. 10, if you are prepared to answer it.

Mr. Doherty—I am afraid to give the results of my figures, for fear they may be wrong. I would prefer answering it through the GAS LIGHT JOURNALS, after having had a chance to verify the figures and be sure of their absolute accuracy. The figures I have been able to arrive at from a hasty calculation are about 18. I would like, however, to have it understood that these figures are the result merely of a calculation made on the spur of the moment and are subject to revision. The result of the calculation, however, is as I have stated, so far as I have been able to figure it at this time.

Mr. McDonald—I always counted on 22 pounds.

The President—We have disposed of all the papers and questions regularly listed. If there are no further questions, we will go into executive session and discuss matters appropriate thereto. Under the rules of the Association all gentlemen present who are not members will be required to withdraw from the convention hall.

EXECUTIVE SESSION.

The President—I believe the matter of appointing a committee to confer with other Gas Associations, with reference to the formation of a National Bureau for Advertising, which was broached at our first session, was deferred until this time. As we are now in executive session that matter can be brought up and disposed of.

A very extended discussion of the proposition was participated in by Messrs. Doherty, Hayward, Andrews, Whysall and McDonald, after which the following question was put by the President:

It has been moved and seconded that we take a rising vote as an expression of opinion, for the purpose of determining the advisability of appointing a committee of one to confer with the other Gas Associations as to the creation of a fund by all of the various Associations, or by an assessment upon the various companies, for the establishment of a National Advertising Bureau, in order to advertise the advantages of the various gas appliances.

The rising vote showed that the motion was unanimously carried.

On motion of Mr. Andrews the President was empowered to appoint a committee of three to consider the subject of electrolysis in connection with other Associations, and to look after the matter in general as affecting gas companies, with directions to report at the next meeting of the Association.

The President—The committee on President's address recommended as follows:

"We recommend that a committee of one be appointed to confer with the electrical associations in connection with the subject of municipal ownership." Also:

"The recommendation regarding the membership committee should be taken up at the executive session, and a resolution offered tending to the appointment of such committee, and possibly laying out a line of campaign, so that we may be enabled to reach every gas works in the State."

On motion, both recommendations were adopted.

The President—If there is no further business to come before the executive session, I now declare the same closed.

RESUMING THE REGULAR ORDER.

Having called the Association to order in open session the President appointed the following

SPECIAL COMMITTEES:

Conference Committee on Municipal Ownership.—Mr. C. W. Andrews, Hamilton, O.

Committee on Electrolysis.—Messrs. R. Montgomery, Youngstown, O.; John Franklin, Cincinnati, O.; Emil G. Schmidt, Sandusky, O.

Committee on Membership.—Messrs. Fred. R. Persons, Toledo, O.; George H. Tayler, Warren, O.; Chas. S. Ritter, Columbus, O.

Committee on National Bureau of Advertising.—Mr. H. L. Doherty, New York.

Mr. Butterworth then read the following

REPORT OF NOMINATING COMMITTEE.

To the Members of the Ohio Gas Light Association: Your Nominating Committee beg leave to report the following names as officers of this Association for the ensuing year:

President—Mr. George Whysall, Springfield, Ohio.
Vice President—Mr. Henry L. Doherty, New York City.
Secretary and Treasurer—Mr. T. C. Jones, Delaware, Ohio.
Executive Committee—Messrs. E. E. Eysenbach, Columbus, Ohio, and Emil G. Schmidt, Sandusky, Ohio.

Respectfully submitted,
C. R. FABEN, Jr.,
IRVIN BUTTERWORTH,
M. COOMBS,
} Committee.

ELECTION OF OFFICERS.

On motion of Mr. John D. McIlhenny the report of the Nominating Committee was adopted, and the President was instructed to cast the ballot of the Association in favor of the election to office of the gentlemen named.

The President subsequently reported the result of the ballot, which notification was received with applause.

ACKNOWLEDGMENTS FROM THE OFFICERS-ELECT.

Responding to calls for "speech," the following responses were made:

Mr. Whysall—Gentlemen, I desire to thank you very much for the honor conferred upon me, and I shall do my best to fill the office.

Mr. Doherty—Mr. President and Gentlemen of the Ohio Gas Light Association: I am very much obliged to you for the honor of electing me your Vice-President for the ensuing year. The Ohio Association is the first Association I ever joined of this character. I read my first paper before the Ohio Association and I have never missed a meeting since I joined it. I came this time all the way from Quebec to attend this meeting. I would like to have some better way of expressing my love for the Ohio Association and my respect and friendship for its individual members, but coming upon me suddenly I really do not know what to say. I am ever so much obliged to you, and whatever duties may fall to me as Vice-President of your Association I will be very glad to give them my first consideration.

Secretary Jones—I thank you very much for this renewed evidence of your confidence. I shall continue as I have done in the past, to use all the efforts and energies at my command for the promotion and success of this Association. The Ohio was my first love, as it was that of Mr. Doherty, and I take great pride in seeing it flourish. I thank yon.

President Lathrop—Is there anything further to come before the Association?

VOTES OF THANKS.

Mr. Whysall—We have had a royal good time here. We always do whenever we come to Columbus. The first meeting of this Association which I attended was held at Columbus. I had a very pleasant time then, and have had this time. I therefore move a vote of thanks to the Entertainment Committee for the royal manner in which the members and our guests have been entertained at this meeting of our Association. (Adopted)

The President—I can only say that Columbus has always been a very hospitable place, and at no time has this fact been forced upon me with as much effect as now.

On motion of Mr. Andrews a hearty vote of thanks was tendered to the officers of the Association for the efficient services rendered by them in carrying the meeting to such a successful conclusion.

On motion, the meeting was declared adjourned.

Electrical Ignition for Gas and Gasoline Engines.

[By MR. P. P. NUNGESSER, in *Electrical World.*]

In the early days of gas and gasoline engine construction the only method of ignition was by what was commonly known as the hot tube. The tube which entered the combustion chamber or cylinder, was heated to redness by a gas or gasoline burner, which necessitated the maintaining of an open flame outside of the engine cylinder. The many dangers accompanying this form of ignition, especially on gasoline engines, made it in some localities extremely hazardous, while there is an uncertainty in the period in which the ignition would actually take place due to high or low compression. Under favorable conditions, such as tight fitting cylinder rings on the piston head, and perfect fitting valves, whereby high compression was obtained and the explosive mixture forced into the hot tube at a pressure corresponding to the igniting temperature, the ignition would take place at a proper period of the stroke, and high efficiency was the result. But a slight leakage at the rings on the piston head lowered the compression which, together with the frequent breakage of the heat tubes, due to the oxidation and other uncertainties of this method of ignition, soon led the inventors and manufacturers of gas and gasoline engines to seek a more reliable means of ignition, free from the many dangers accompanying the use of the hot tube.

This method was found in the application of the electric igniter to such engines. However, many builders of gas and gasoline engines have frequently met with difficulties, and sometimes failures, in their efforts to obtain satisfactory results in the electrical ignition under the various conditions existing. This is due to the many details which are overlooked and regarded by many builders as unimportant.

The great strides that have been made in the perfection of the gas and gasoline engine, especially adapted for automobile service as well as all forms of stationary motive power, have made this a very important industry, the growth and magnitude of which can hardly be conceived by those not directly or indirectly interested in this progressive industry. The high state of perfection met with to-day in this important source of mechanical energy as applied in its comparatively new field of usefulness on automobiles and pleasure yachts, is due in a measure to the great improvement made in the electric igniters, spark coils and batteries. Perfect ignition is the most important factor in producing successful results. Engines which have igniters that combine dura bility with simplicity of construction have met with the greatest success in the hands of the average operator.

The writer will endeavor to explain the most successful igniting devices in use at the present time. They consist of two distinct classes—the primary and the secondary—the latter commonly called the "jump spark" igniter. The primary igniters which are by far the most largely used by the engine builders in this country, are constructed in three distinct forms. The first, known as the striking or "make and break" contact, employs points which are made to pass through the side of the cylinder or through the cylinder head into the combustion chamber. The movable point which strikes against the stationary point is actuated by a suitable mechanism on the outside of the cylinder. The mechanism is usually so arranged that ignition can be produced at the highest point of compression, or at the point where the highest efficiency is obtained with the combustible mixture employed.

The second form of primary ignition, commonly known as the rotary or wipe spark igniter, is not so largely used as the striking or make and break type just described. One objectionable feature which the writer has not yet seen successfully overcome in the rotary type is the great wear in the sliding contact points. It is true this form of ignition produces a much larger spark with the same consumption of battery power than the striking or make and break igniter, but the frequent attention that this form of sliding contact ignition requires to keep it in perfect condition, will prevent it from ever coming into so popular favor as the striking or make and break ignition.

The third form of primary ignition used is the make and break igniter known as the inside igniter. This igniter is constructed by passing an insulated stationary rod through the side wall of the cylinder, or through the cylinder head. The movable part of this igniter is attached to the piston head inside of the cylinder, and when the piston head compresses the explosive mixture to the highest point of compression, the igniter, which has been brought in contact by the forward motion of the piston is separated by the movement of the piston head, thereby igniting the mixture. There are many other forms of primary ignition in use, but those described above are the most largely used in this country.

The second class of igniters, commonly known as the jump spark igniters, have only one form of construction. This is an insulated plug through which the wires from the induction or secondary coil pass to the inside of the combustion chamber. The two wires which pass through the insulated plug are usually spaced from $\frac{1}{4}$ lo $\frac{3}{8}$ inch in passing through the plug, and curved inward or toward each other to allow from $\frac{1}{4}$ to $\frac{5}{16}$ inch air space through which the spark passes from the positive to the negative wire. It will be noticed that no movable parts exist in this form of ignition. When the battery is closed by suitable insulating plates on the revolving shaft of the engine, a spark is produced in the combustion chamber or cylinder.

The insulating plugs used for this secondary current or jump spark ignition must necessarily have very high insulating properties. They are usually made of so-called lava or soapstone, or of mica having high insulating properties.

The Rhumkorff or induction coil, as it is sometimes called, which is used to produce the jump spark, is constructed with a primary coil of coarse or heavy wire having a soft iron core. Over the primary coil is wound a great many layers of very fine, insulated copper wire, having no metallic connection with the wires of the primary battery coil.

When a battery current passes through a primary coil it magnetizes the iron wire core, and also charges a tin foil condenser, usually placed in the base of the coil. When the battery circuit is closed a current of very high voltage is produced by induction in the secondary coil, the ends of which terminate in the ignition plug inside of the combustion chamber. This high voltage causes a spark to pass from the positive to the negative wire inside of the combustion chamber.

To ignite an engine successfully with any of the above forms of ignition a battery of great strength and durability is absolutely essential. These requirements have to be met by a closed circuit battery manufactured expressly for the purpose. Practical tests and demonstrations on automobile and yacht engines have shown that a battery having from $4\frac{1}{2}$ to 6 volts, or $\frac{3}{4}$ to 1 volt per cell is required. The battery should have a very low internal resistance, and have an amperage or discharge rate of from 8 to 16 amperes on closed circuit measurement.

Too much cannot be said about the use of a suitable primary spark coil in connection with any of the primary igniters. It has required many tests to determine the correct resistance for a coil. If the resistance is too low the coil will allow too large a flow of current from the battery, thus wasting very much of the battery power, and also frequently destroying the platinum points on the igniter. To obtain the best results, from $1\frac{1}{2}$ to 2 amperes should be the limit of discharge through the coil. Coils are now wound for 4, 6 and 8 cells, as the case may be.

Since the early days of electric ignition, many forms of spark coils have been used; in fact, any coil that would produce a large spark was considered the correct coil to use irrespective of the great waste in battery power. Many spark coils in use to-day are wasting as much current as is required to successfully ignite the engine. This is due to the very low impedance of such spark coils, which allows a greater quantity of current to flow through the coil when the circuit is closed, than is necessary for successful ignition. This waste of current is prevented by having the correct impedance in the coil so as to produce a reliable spark and prevent any waste in the battery power. It has been found from actual tests on modern engines that by having a coil of the correct impedance the life of the battery may be doubled.

Another great improvement in ignition and saving in battery power was effected by discarding the old style long coils, which were 8, 10 and 12 inches in length, an erroneous idea having existed that a long coil would produce a larger spark. Practical experience and tests have shown that a primary spark coil best suited for high speed engines, such as used on automobiles and pleasure yachts, should not exceed 6 inches in length over all. The 8, 10 and 12 inch coils will not, with the same consumption of battery power, magnetize and demagnetize as rapidly and completely as the 6-inch coil; consequently the latest improved primary coil has an extra large diameter core, which is composed of No. 20 annealed Swedish iron wire, reannealed after cutting to 6 inches in length. A coil having a core made of this grade of iron and with this degree of care, will magnetize and demagnetize instantaneously. This enables the engine builders to provide for only a short duration of close; that is, allowing the circuit to remain closed less time than would be required to produce the same results with an 8, 10 or 12-inch coil. It is, therefore, a great economy in battery power to use a 6-inch coil, and the results are much more satisfactory.

Another important feature in the construction of primary spark coils for automobile use, is the thorough waterproofing of the spark coil to produce thorough insulation under all conditions met with in portable use. No spark coil, if not proof against dampness and moisture, will give satisfactory service for any period of time; it is, therefore, necessary to have the spark coil thoroughly waterproof.

In the opinion of the writer, no form of dry battery should be employed for continuous use. The first cost of a dry battery and sal-ammoniac battery is very low, but its life in heavy service is very short. Dry batteries are sometimes used for starting an engine where a dynamo is used for continuous ignition. A number of builders are using dry batteries for starting their engines, and as soon as the required maximum speed is obtained, an automatic switch cuts the battery out of the circuit and closes the dynamo circuit. This is also sometimes accomplished with a two point switch, and the dynamo will then ignite the engine until the speed is reduced. While the dynamo or generator is used, the batteries are at rest.

The writer considers a good portable closed circuit battery not only more economical than the dry battery and dynamo combination, but it requires less care, as there are fewer parts to become disarranged in the rough service to which ignition devices are subjected to in gasoline propelled automobiles and pleasure yachts. It is a mistaken idea that dynamos or magneto-generators do not require any attention or repairs. The high speed at which these generators are usually driven produces considerable wear on the movable parts, so much so as to have caused them to be abandoned by many of the progressive builders.

Many builders of automobile and yacht engines have had difficulties,

no doubt, with the many forms of closed circuit batteries. These difficulties are sometimes easily located. A closed circuit battery in which a paraffine oil must be used on the solution, is objectionable, as it will be found to give short life and comparatively poor service, for the reason that the rough usage in carriages and boats causes the paraffine oil to coat the elements and interfere with the action of the battery. A perfectly sealed or liquid-tight battery does not require any oil to protect the solution from the atmosphere. A battery which may show excellent service in stationary use may be a complete failure in portable use.

There are no trade secrets about electrical ignition. The degree of success that the various manufacturers are meeting with depends entirely upon the amount of attention that has been given to the most important details, which the writer has endeavored to explain in this article. There are perhaps other causes for success or failure in electrical ignition, but those referred to in this article are from the writer's personal experience, and observations made in the past ten years, or since the development and perfection of the gas engine.

Methods of Checking Arithmetical Calculations.

[By Mr. Willis Whited, in *Engineering News*.]

The computer often has long and complicated calculations to make which cannot be thoroughly checked, and as the accuracy of the result may be very important, his anxiety lest he make a mistake, may absorb more nervous force and time than the actual calculations. Generally, the greater part of the time and nervous energy are spent on the arithmetical part of the work in which mistakes are not apt to be so easily detected as in the other parts of the work. If it is not practicable to have somebody else go over his work, an excellent way to detect non-arithmetical mistakes is to go over it himself some days afterward.

If logarithmic or trigonometrical tables are used it is a good plan to employ different tables in reviewing the work; not so much on account of possible errors in the tables, as because other tables being differently arranged present a different appearance and employ other methods of interpolation.

In addition, all the proof that is generally needed, if the computer is reasonably skilful, is to add both up and down, unless the column is very long or there is liability of getting the columns mixed; in such cases the column of numbers should be copied on a separate piece of paper and divided into parts. Another excellent check is to add again, adding in the carried figures after the others, instead of before, or vice versa. In subtraction, adding the subtrahend and remainder is all that is needed; but it is a good plan to cover up the minuend while doing so. In multiplication, the simplest check is by excess of 9's, and it is pretty reliable unless the numbers multiplied are very large. There is, however, always a possibility of getting one figure too small, and another the same amount too large in the product, or of making the mistakes illustrated:

548	548
206	26
3288	3288
1096	1096
14,248	112,888

Mistakes of this class would not be detected by excess of 9's; but the first one probably would be found, and the last two surely would be, by excess of 11's. The latter method is a little more trouble than the former. If the numbers are large it is a good plan to check the partial products separately, and, of course, prove the addition by one of the methods above mentioned.

An excellent plan, one which avoids nearly all mistakes and often saves much time, is to form a table of the products of the multiplicand as follows:

1. 548	3. 1,644	5. 2,740	7. 3,836	9. 4,932
2. 1,096	4. 2,192	6. 3,288	8. 4,384	10. 5,480

Form the table by addition and check by multiplication, where it can be done by multiplying by 2 or 5, and the last will prove the whole. This table is easily constructed and saves much time where the same multiplicand is used more than once, or where the multiplier is very large.

One of the best proofs, although somewhat laborious, is to reverse the position of the multiplier and multiplicand; this proof is almost absolute and has the advantage that if a mistake is found to exist it gives a pretty good clew as to its location. This has the same value whether the numbers are large or small. Another proof which is easily made and is practically absolute, is to divide the product by some aliquot part of the multiplier, which does not contain 2, 3 or 5 as a factor, and see that it divides exactly. If the same factor occurs also in the multiplicand it is well to use its square. If the multiplier is not readily factored it can be used as it is. As the quotient of this division is not required it will save time to add or substract multiples of the factor chosen in such a manner as to reduce the number of figures in the product as rapidly as possible as follows:

	2896358
	26
	17378148
Take the factor 13.	5792716
	75305308
	+52
	7530536
	−65 − 26
	103051
	+39
	10309
	−39
	1027
	+13
	104=8×13

which proves the work. This method is very convenient where the multiplier is not very large.

If the numbers multiplied contain decimals and all figures below a certain value are rejected, about the only available proof is to reverse the position of the multiplier and multiplicand as above mentioned, although a method similar to the following can sometimes be used to advantage:

68.74932	
526.8479	
34,374.660	
1,374 986	
412.496	
54.999	
2.750	
.481	
.062	
	1,000.0000
36,220.434	526.8479
27,499.728	
4,812.452	473.1521
206.248	
6.875	
3.437	
.137	
.007	
68,749.318	

It will be seen that in the first multiplication the figures of the multiplier are used from left to right, and the decimals beyond three places are omitted, considerably abbreviating the work. The partial products below 36,220.434, are formed by again multiplying the multiplicand by the complement of the multiplier (473.1521) in the same manner, and adding the partial products as shown. The sum should equal the original multiplicand with the decimal point removed three places to the right.

This method of proof is practically conclusive and is quite easily applied if a table of multiples has been formed similar to that given above.

Division may be checked by excess of 9's or 11's, the latter being far better, although not quite so easily applied; the mistakes in the following examples would not be detected by excess of 9's, but would be by excess of 11's:

26) 89765 (33152	26) 272845 (1494
78	26
117	128
78	104
39	244
26	234
136	105
130	104
65	1
52	
13	

The table of multiples is of greater assistance in division than in multiplication, and is peculiarly applicable in both when a few decimal places are omitted. In the latter case the tests by excess of 9's and 11's are not applicable. Probably the only available proof is to multiply the divisor and quotient together, and add the remainder. If a table of multiples is used the quotient may be used as the multiplier, otherwise the divisor should be used as the multiplier. Occasionally time will be saved by multiplying the divisor by the arithmetical complement of the quotient, adding the dividend and subtracting the remainder as follows:

42) 3750 (89
336
390
378
12

100 — 89 = 11.

3,750
42
42
4,212
12
4,200 = 42 × 100

which proves the work.

The Carbonization of Coal for the Production of Illuminating Gas.

In a paper on this subject, read by Mr. W. R. Herring, Chief Engineer and Manager to the Edinburgh and Leith Gas Commissioners, at a recent meeting of the Royal Scottish Society of Arts, the author had this to say respecting inclined retorts:

The physical properties of all solid bodies in a disintegrated state, whether in the form of powder or in a granular state, or in an irregular lumpy condition, to assume a natural angle of repose when thrown or tipped into a heap is well known to us all, and the particular angle which various bodies assume is known as its angle of repose. It cannot be claimed that the application of this known tendency of solid bodies to assume an angle on an inclined plane, at which it will lie in repose for any length of time, is in any way novel as applied to the charging of materials into retorts or other receptacles. It appears to have been first applied to the feeding of retorts for the carbonization of coal in the year 1851, under a patent granted to one Alfred Vincent Newton. Another patent was granted, in the year 1854, to a French engineer, Aristide Balthazard Berard, of Paris, who claimed to "distil the coal in cylindrical conical fireclay retorts having its axis inclined to the horizontal to an angle of not less than 40° nor more than 60°." A further patent was granted to Robert Griffiths, in 1863, the primary object being the extraction of coal oil; the retort being "built or fixed at such an angle and elevation that when small coals are placed upon the upper end of the retort they will slide down the sloping bottom thereof by their own gravity." In 1864 a patent was granted to Stephen Kerry for the calcining of bones and for reburning and revivifying animal charcoal. In this the inventor claimed "for the laying and setting of the retort in an inclined direction at such an angle as will allow the contents to run down the retorts by their own gravity, or by the force of supply at the upper end, the angle preferred being 32½°." Similar patents were also granted in 1872, 1873 and 1878, but it was not until 1889 that any practical installation appears to have been taken seriously by the gas engineering profession.

Fate, however, was more kindly disposed to the inventor who revised the system and obtained a patent for the same in 1885, Andre Coze, Director of the Gas Company at Rheims. A small installation was erected at the Rheims gas works, which was in successful operation for some time, and so much impressed British gas engineers who had the opportunity of inspecting the same that arrangements were made by the Engineer of the Brentford Gas Company, Mr. Frank Morris, to put down a small installation at his works; this taking place about the end of 1889. In the year 1890 a large installation was erected at one of the London works on Coze's model; but experience proved that on a large scale the system, as then existing, was not applicable to British practice. Not only were the physical difficulties experienced insurmountable, in consequence of the impossibility of keeping a tight joint between the iron shoot of the fireclay retort buried within the red-hot brickwork, and also in consequence of the coal choking upon the bend, but the conditions under which the men charging the retorts had to work, exposed as they were to the heat, flame and smoke from the open mouthpieces at the top, were such that no workman could be honestly put to perform the operations. The Engineer of the Brentford gas works, anticipating these difficulties, after experience with his own experimental installation, set to work to revise the system and to adopt the principle to the English practice, and by his labors a very considerable advance was made in rendering the invention a practical success. In fact, to all outward appearances the modifications introduced by Mr. Frank Morris stand good to-day, notwithstanding the fact that many important details and simplifications of construction have been introduced by other engineers who were engaged in pioneering the system in its early introduction into this country.

At a period when labor troubles were very pronounced in the gas industry, gas administrators lent a more willing ear to any method which promised to relieve them of the increasing cost for labor, and more particularly the difficulties of dealing with it when paid at the higher rate; and it is no doubt primarily due to this fact, and also to the threatened competition of the electric light, that gas engineers were induced to really take the innovation seriously. In 1891 the author was instructed by the Huddersfield Corporation to carry out an entire reconstruction and extension of their gas works, to carbonize 400 tons of coal per day. He naturally looked seriously into the question of the application of inclined retorts as against the then best known methods of setting horizontal retorts and charging them by power driven machinery. The result of such investigations led him to advise the Huddersfield Corporation to carry out their extensions solely on the principle of the inclined retort system. At the outset a plant was designed for carbonizing 180 tons of coal per day, to be constructed within a then existing building. A further development of the reconstruction scheme necessitated a further extension of the carbonizing plant within twelve months from the former plant being put to work. It had, however, worked in such a satisfactory manner that the further extensions were carried out on exactly similar lines, with improvements in details which experience had shown to be necessary. This plant—designed for carbonizing 220 tons of coal per day—was constructed within a new building, which was designed for the purpose; and by supporting the roof upon a circular girder construction the plant can be conveniently constructed within such a building without the side walls of the same being carried unusually high, the upper parts of the structure of the plant being practically above the side walls of the building.

Since this plant was put to work in 1894, the whole of the coal gas manufactured in Huddersfield has been produced from inclined retorts. Prior to the introduction of the newer system the wages for this purpose cost 3s. 4 19d. per ton manipulated, whereas during 1899 exactly similar costs were only 1s. 9d. per ton. The Brentford Gas Company's works, as far as the author knows, is the only other works of any considerable size where the whole of the gas has been produced from inclined retorts for some years past, and upon reference to reliable statistics I find that, prior to the introduction of inclined retorts, the Brentford carbonizing wages were 3s. 5.35d. per ton of coal, whereas for the last completed financial year they were 1s. 11.8d. Thus Huddersfield shows a saving of 1s. 7.19d. per ton of coal and Brentford 1s. 5.55d. per ton of coal. From these figures it will therefore be seen that it may be reasonably estimated that by this method of coal gas manufacture, as compared with the best known methods hitherto in existence, it will be quite safe to estimate on a saving of, say, 1s. 6d. per ton of coal, which sum, upon the total coal carbonized per annum, amounts to nearly £1,000,000.

This figure cannot, however, be altogether accepted as the economy brought about unless it can be shown that the cost of the construction of the new plant is no greater than that of the plant it is intended to take the place of. Upon this point it is very difficult to arrive at comparative figures. So far as the author's experience goes, when taking into account the fact that a greater producing power can be obtained from a given area of land, and that a retort house, properly constructed, is less in cubical capacity for a given unit of production, the cost for the inclined retorts is not greater than for a similar installation of horizontal retorts equipped with power-driven mnchinery for drawing and charging the same.

A small installation of the inclined retorts was constructed at the Edinburgh gas works early in 1899, and were put under fire in July of the same year. The object of giving a small installation in the old works at Edinburgh was to permit of careful investigations being made into the physical characteristics of Scottish coals when worked on the basis of gravity charging, the system not having been previously worked in Scotland. The plant erected is an identical unit of the multiple that is to form the carbonizing plant at the new gas works now in course of construction at Granton. The setting was put to work in the early autumn, under ordinary practical working conditions, and up to the present time every conceivable class of coal has been passed through the same, with the result that valuable information has been accumulated as to the physical characteristics of the various classes of coal when charged and carbonized in inclined retorts; from which it is evident that the principle requires special modification for dealing with the differing classes of coal such as are to be obtained in Scotland. The modifications, however, are mostly of a minor character; but yet of sufficient importance in themselves to make or mar success. The designs for the larger work to be erected at Granton are now in process of completion, in the light of the experience gained at the Edinburgh works, and it is anticipated that the new plant will be completed in about eighteen months time.

Mr. Herring illustrated his paper by numerous diagrams and models.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Logan Iron Works, of Brooklyn, N. Y., have just contracted for a holder and other apparatus to be erected in Los Angeles, Cal.

IT was stated last Tuesday, on the authority of Mr. C. K. G. Billings and Mr. A. N. Brady, of the Peoples Gas Light and Coke Company, of Chicago, that a syndicate friendly to the Peoples Company has bought the Ogden Gas Company and the Cosmopolitan Electric Company.

AT a meeting of the Board of Directors of the Ogden Gas Company, held last Tuesday, the following statement was issued for publication: "Pursuant to the notice given to the stockholders 30 days ago, under the Illinois Statute, these met to-day at the office of the Company, the total capital stock aggregating $5,000,000, being represented. The action taken at the meeting was unanimous. The meeting resolved immediately to increase its capital stock from $5,000,000 to $10,000,000,

the increase of $5,000,000 to be represented by 50,000 additional shares of $100 each. The meeting further resolved to issue $6,000,000 of 50-year 5 per cent. gold bonds to be secured by a trust deed to the Farmers Loan and Trust Company, of New York. The proposition which was received some days ago to purchase the $6,000,000 bond issue was accepted, and the contract for that purpose signed and delivered. The first installment of 10 per cent. of the purchase price of the bonds was paid down by the buyer and deposited with the Company. The remainder of the purchase price is to be paid under the contract as soon as the bonds can be prepared and signed." This undoubtedly means that the artificial lighting of Chicago from central stations has finally passed into the possession of those who control the Peoples Company.

THE following interesting budget from "Observer" bears date of the 10th inst.: "The investigation by the Committee on Manufactures of the Massachusetts Legislature into the affairs of the Boston Gas Companies has been dragging along its weary length. Whatever may have been the cause of its starting, it has now become an attempt to show up the real inwardness of the New England Gas and Coke Company and of the Massachusetts Pipe Line Company. Plain charges of the expending of $500,000, more or less, in 'arguments' helping to procure the charters of the above Companies, were made by Mr. Donahue, confidential man of J. Edward Addicks, and by T. W. Lawson. These charges were repeatedly made and as flatly denied, all under oath, and the hearings descended to personal bickering, until stopped by the Chairman.

"Mr. Anderson, counsel for the prosecution, presented tables showing the cost of gas in minutest detail for a series of years, in Boston and other large cities in Massachusetts, and claimed that gas could and should be sold for 75 cents per 1,000 cubic feet in Boston.

"These tables show what a rod in-pickle has been prepared for the gas companies by compelling them to make returns of detail for public record, which can be and are so readily turned against them, for while figures won't lie, they can be made very misleading.

"Formal demand was made upon the Coke Company for opportunity to inspect its books, but although Mr. Whitney in his opening courted the fullest investigation into the affairs of the Company, it so *happens* that all the Trustees are away from the State, and counsel for the Company will not permit the examination of the books, claiming that the Company is not a gas company but a coke company, and so, although it is supplying about half the gas used in the city of Boston, and more millions of feet per day than many other companies of the State make in a year, it bids fair for the moment to escape placing itself upon record as other companies are obliged to do.

"If such reasoning will stand, there appears to be no cause why some of the companies cannot reorganize into a pipe line company and a spent oxide company, for which residual there is now a good market, and dispose of its surplus gas to the pipe line company. Meantime, the respondents open their case to-day, and claim they will become bankrupt if forced to sell gas at any price below $1 or $1.10; and of this I will write you later.

"According to the Lowell papers, the deal between the parties who proposed to duplicate the Haverhill scheme in Lowell and the shareholders of the Lowell Gas Light Company has fallen through. The failure to carry out the trade rested with the promoters, and the latter will forfeit the sum of $20,000 now deposited with the Old Colony Trust Company, which will go to enrich further the holders of the Lowell Gas Light Company's shares. Writing of Lowell, it is with pleasure I report the continued improvement in health of Mr. Farnham, the popular Superintendent of the Company. Mr. Farnham has been seriously ill for several weeks, but is now out again, and will soon have regained his usual form.

"The Boston subway explosion case came to notice again a few days ago, in the hearing of arguments of counsel by the full bench of the Supreme Court, upon the exceptions of the defendant, in the action brought by the boot-black, Wolf Kaplan, against the Boston Gas Light Company. Kaplan holds a verdict of $3,000, as a result of a long trial in the Superior Court. This is the test case of many suits brought on account of the explosion, and its outcome is awaited with much interest.

"No further matter of moment relating to the Haverhill case is learned. The ordinary consumers are paying their bills at the rate of $1 per 1,000, but the city is declining to do so. No date has been fixed for the hearing on the injunction by the court.

"No decision has been made as yet by the Board of Gas and Electric Light Commissioners on the petition for the reduction of the price of gas in Lynn, the price in which city is $1 per 1,000. Under the circumstances it would look that the Company there might fairly petition for the right to increase to $1.10, considering the advance in all materials entering into the construction and operating of a gas works. The various other reduction petitions have not been heard of yet. The dates for the Lowell and other hearings have been set ahead.

"In the Holyoke matter, where the city has formally voted to take the plant, and extended hearings have been held before a commission to fix a price on the property, a new phase was noted in the presentation of a bill to the Legislature, accompanied by a petition of the Mayor and city authorities, to allow the citizens of Holyoke to vote as to whether they will or will not authorize a contract between the city and the Gas Company for 10 years, and abandon action in the matter of taking the plant for that time. It is generally conceded that such action would be advantageous all around.

"The refusal of the Coke Company to show up its cost of manufacture is taken to mean that it comes higher than it would like the holders of its securities to know. An uncertainty is better than a certainty!"

MR. B. E. LETANG, proprietor of the Jackson (Cal.) gas and electric light works, has perfected the latter division of the plant. He admits, however, that the gas end of the trading yields the more satisfactory returns.

MR. GEORGE E. HOPPIE advises us that all persons who hold claims against the South Amboy (N. J.) Gas Light Company should forward statement of amount to him at his address, 71 Broadway, New York.

MESSRS. Daniel K. Brower and William Manson have severed their relations with the National Coal Tar Company, and have engaged in business on their own account, under the firm name of the "Coal Tar Product Company." Their headquarters are at 71 Commerce street, Brooklyn, N. Y.

THE properties of the Belvidere (Ills.) Gas Light and Fuel Company and of the Belvidere Light, Heat and Power Company have been purchased by capitalists, non-resident of Belvidere, who reorganized and combined under the title of the Belvidere Gas and Electric Company. The capital stock was increased to $150,000, and it is said that quite a sum will be expended in plant betterment. The officers of the Company are: Directors, A. J. Stahl, W. H. Schott, E. B. Magill, Edward Barrett and J. M. Nylen; President, A. J. Stahl; Secretary, W. H. Schott.

MR. WILLIAM J. SCOTT, Secretary and Treasurer of the Milton (Pa.) Gas Company, died at his home in Milton the evening of April 5th. He was in his 45th year.

THE proprietors of the Millville (N. J.) Gas Light Company have decreed that, until another notification, the gross selling rate shall be, for an illuminating service, $1.50 per 1,000 cubic feet, prompt payment to entitle the user to a rebate of 5 per cent. Those who use 5,000 cubic feet or more per month will be entitled to a rebate of 10 per cent. Users of gas on fuel account will be entitled to a rebate of 10 per cent., provided their bills show a use, during each of the months of May, June, July, August and September, of not less than 1,000 cubic feet, and of not less than 2,000 cubic feet during January, February, March, April, November and December.

WE understand that Mr. A. L. Fennessy has bargained for and completed the purchase of the "properties" of the Middletown (Pa.) Gas Light Company. Advices by way of Harrisburg are to the effect that Mr. Fennessy proposes to make "big" improvements on the Middletown works.

MR. SIDNEY A. KENT, whose manipulative genius was prominent in the reorganization of the old Chicago gas properties, died at his country home in Suffield, Conn., about a fortnight ago. He was born in Suffield in 1834, and removed to Chicago in 1853, where, in one way or another, he garnered quite a fortune.

THE new holder for the York (Pa.) Company, which has a capacity of 200,000 cubic feet, is in satisfactory operation.

PRESIDENT PRATT, of the Capital City Gas Company, of Des Moines, Ia., says that, if the pipe can be secured at anything like a fair figure, the proposed extension to the outlying district of Highland Park will be made this season.

(*Continued on page* 617.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
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CHAS. E. SANDERSON,
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New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 16, 1900.

(*Continued from page* 617.)

THE proprietors of the Peekskill (N. Y.) Gas Light Company have put the selling rate at $1.60 gross, with a discount of 10 cents for prompt payment.

THE Matawan and Keyport (N. J.) Gas Light Company has made a notable concession in the selling rate. If the Company would improve its purifying system the consumers would be further benefitted.

MR. WILLIAM P. ENGEL, of Charlotte, Mich., is said to have purchased from Mr. W. V. Coons a controlling interest in the gas, electric light and railway properties formerly owned by the Defiance (Ohio) Light and Railway Company.

THE shareholders of the Consumers Gas Company, of Newburgh, N. Y., have negatived the proposition to amalgamate with the Consolidated Gas, Electric Light, Heat and Power Company of Newburgh.

MR. HENRY SMITH, whose term of service in connection with the gas supply of Philadelphia dated from 1846, died the morning of the 5th inst. Shortly after the United Gas Improvement Company took over the Philadelphia plant Mr. Smith was retired on a pension.

THE capital stock of the Butte (Montana) Gas Company has been increased to $425,000 from $300,000.

The Market for Gas Securities.

The market for city gas shares was much on the anomalous order last week; in fact there was no order at all about values. The Exchange closed for Good Friday, and the interregnum was extended to Sunday, which should give the brokers plenty of time for the practice of piety. Meanwhile it is right to say that gas stock quotations may next week reflect some of the conclusions likely to be reached between the "gas magnates" over their conferences since Thursday last. The trading in city gas shares was very limited, and the tendency of prices was downward, although the indications to those straddling the limbs pointed to higher rather than lower values. Consolidated closed yesterday (Thursday) at 188¾ to 189¼. New Amsterdams were notably weaker, closing at 28½ to 30.

The undoubted strong gas stock in the market is Brooklyn Union, and it would not be a surprising thing to see it quoted within six months at 200. Chicago gas purchasers have discounted the Ogden settlement, and the result is considerable falling off in its nominal value. It is worth much more than the value shown in current quotations. Bay State spurted a trifle during the week. Baltimore Consolidated, on recent free offering of investment stock, weakened to 51¼, at which price it is a decided purchase. The general situation is undeniably in favor of gas shareholders.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

APRIL 16.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,200	100	188¾	189½
Central Union, Bonds, 5's.	3,000,000	1,000	103½	105
Equitable Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	275	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	28½	30
Preferred	10,000,000	100	51	54
Bonds, 5's	11,000,000	1,000	100	101
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	100	115
Preferred	5,000,000	100	125	140
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,65	500	180	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	152½	153
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1⅞	2
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	40	..
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	..	77½
2d " " "	3,000,000	1,000	42	45
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	69	71
Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000		108
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	195¾	196½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	51¼	51½
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	19	21
" Con. Mtg. 5's	880,000	1,000	87	90
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	95¾	96
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	100	105
" Bonds, 6's	2 650,000	..	101	103
Jackson Gas Co	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Lafayette Gas Co., Ind.	1,000,000	100	40	45
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	106	
Laclede, St. Louis	7,500,000	100	72	75
Preferred	2,500,000	100	100	100½
Bonds	10,000,000	1,000	110	110½
Madison Gas & Elec. Co.	400,000	100	82	..
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Con. Gas Co	6,000,000	..	..	..
Bonds, 6's	4,600,000	..	..	..
Essex and Hudson Gas Co.	6,500,000	..	35	40
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	43	45
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	107⅛	107¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111⅜	111¼x
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	54	54⅛
St. Paul Gas Light Co.	1,500,000	100	57⅛	58⅛
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90⅛
St. Joseph Gas Co	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	..	15
Bonds	1,612 000	1,000	85	90
Washington, D. C	2,600,000	20	273½	273¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	..	92
Bonds, 5's	3,830,500	.	104	106
Wilmington, Del.	600,000		220	50

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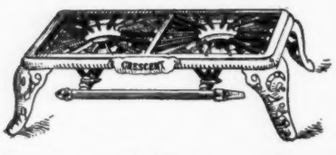

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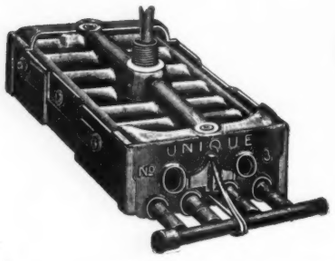

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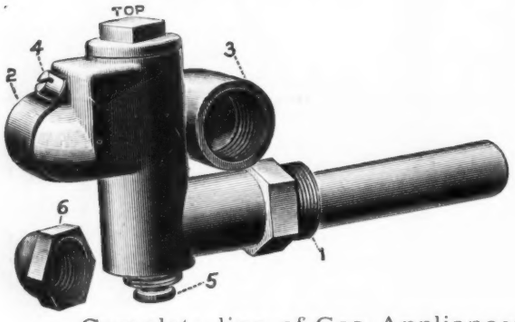

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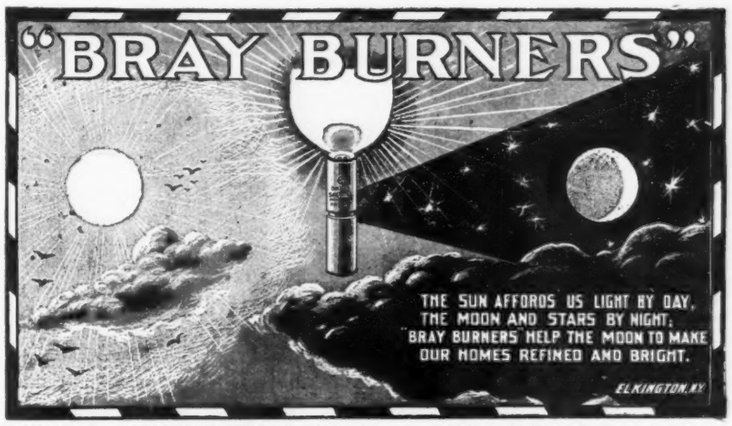
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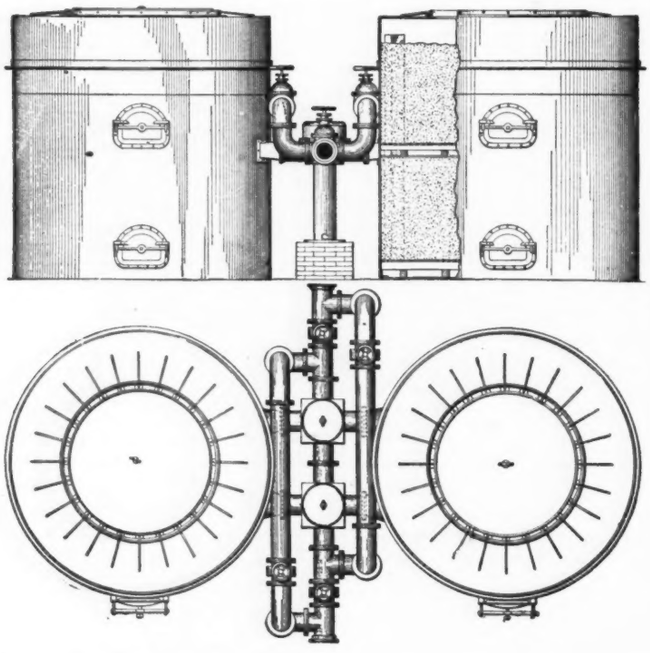

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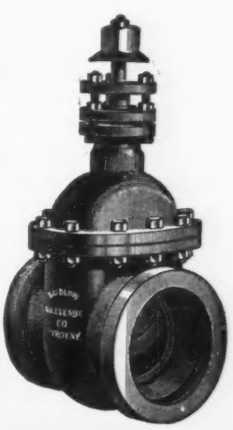

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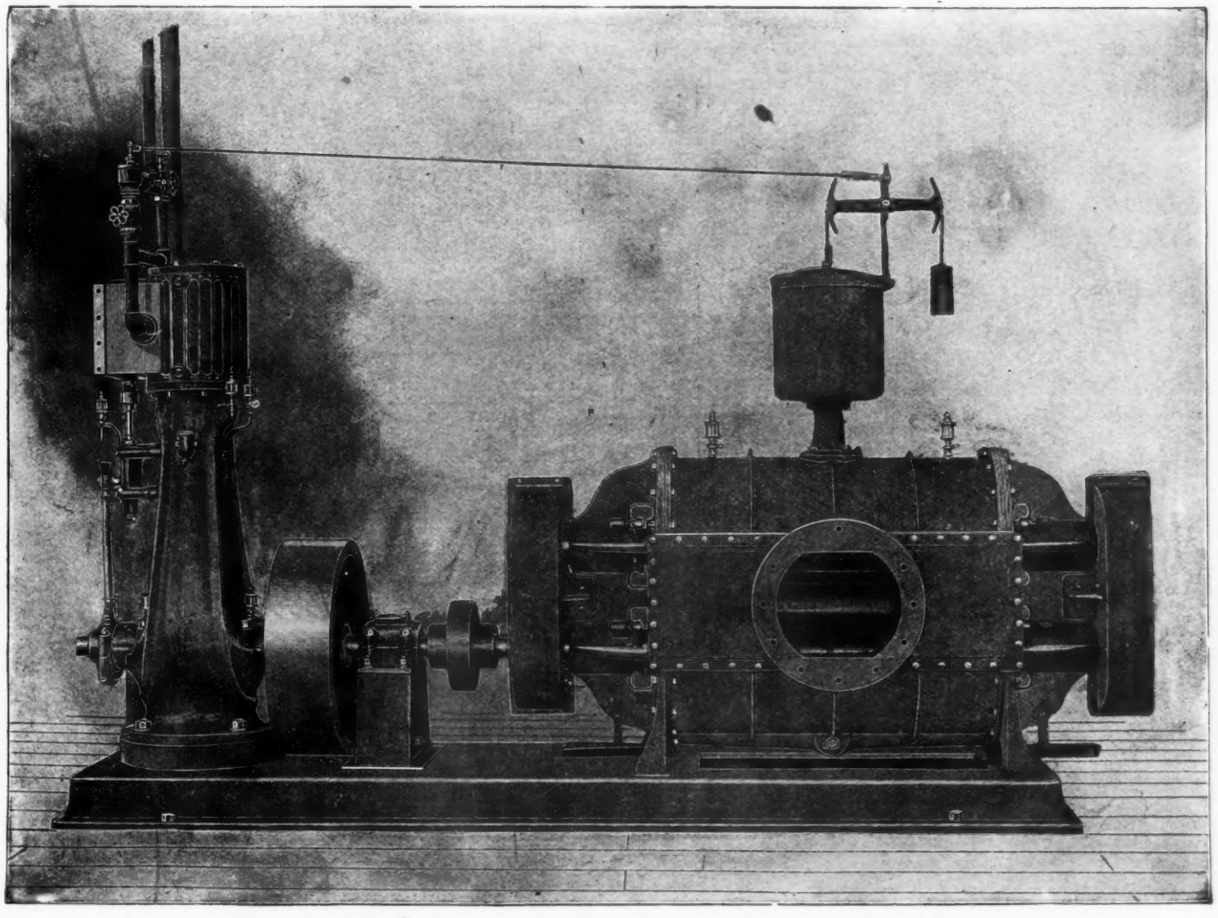

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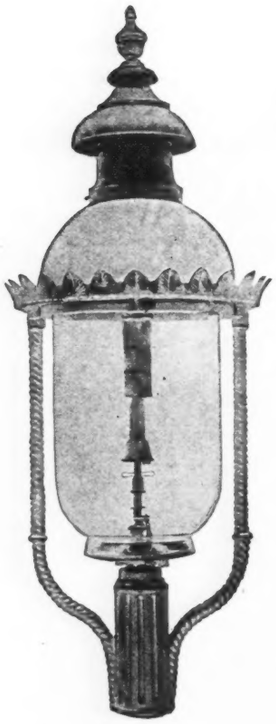

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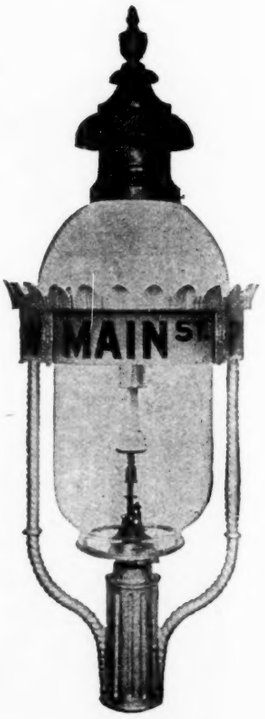

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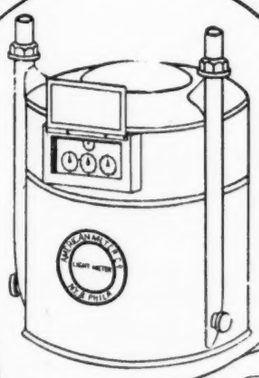
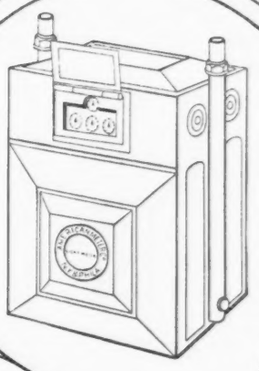
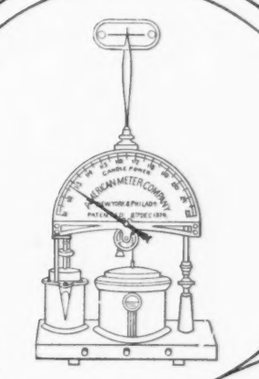


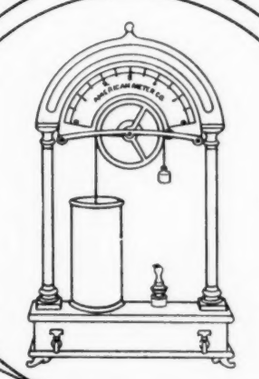


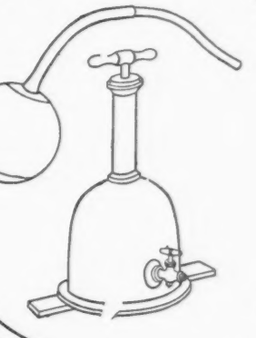
PUBLIC LIGHTING TABLE.

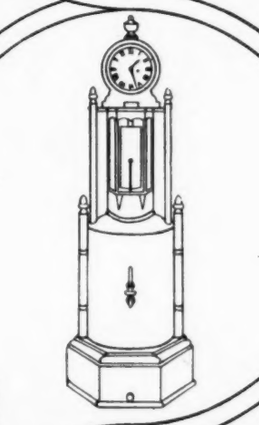
MAY, 1900.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	7.20 PM	4.00 AM	6.45	4.00
Wed.	2	7.20	4.00	6.45	4.00
Thu.	3	10.30	4.00	6.45	4.00
Fri.	4	11.10	4.00	6.45	4.00
Sat.	5	11.40	4.00	6.45	4.00
Sun.	6	12.10 AM FQ	3.50	6.45	4.00
Mon.	7	12.40	3.50	6.55	3.40
Tue.	8	1.00	3.50	6.55	3.40
Wed.	9	1.30	3.50	6.55	3.40
Thu.	10	1.50	3.50	6.55	3.40
Fri.	11	2.20	3.50	6.55	3.40
Sat.	12	2.50	3.50	6.55	3.40
Sun.	13	No L.	No L.	6.55	3.40
Mon.	14	No L. FM	No L.	7.00	3.30
Tue.	15	No L.	No L.	7.00	3.30
Wed.	16	7.40 PM	10.20 PM	7.00	3.30
Thu.	17	7.40	11.10	7.00	3.30
Fri.	18	7.40	11.50	7.00	3.30
Sat.	19	7.40	12.30 AM	7.00	3.30
Sun.	20	7.40	1.10	7.00	3.30
Mon.	21	7.40 LQ	1.40	7.10	3.15
Tue.	22	7.40	2.10	7.10	3.15
Wed.	23	7.40	2.40	7.10	3.15
Thu.	24	7.40	3.20	7.10	3.15
Fri.	25	7.40	3.40	7.10	3.15
Sat.	26	7.40	3.40	7.10	3.15
Sun.	27	7.50	3.30	7.10	3.15
Mon.	28	7.50 NM	3.30	7.15	3.15
Tue.	29	7.50	3.30	7.15	3.15
Wed.	30	7.50	3.30	7.15	3.15
Thu.	31	7.50	3.30	7.15	3.15



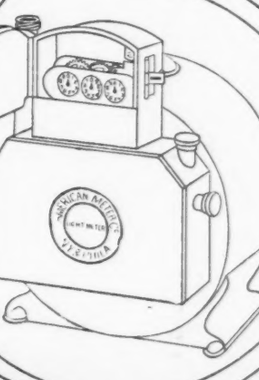


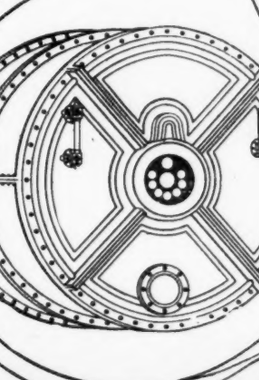




TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45





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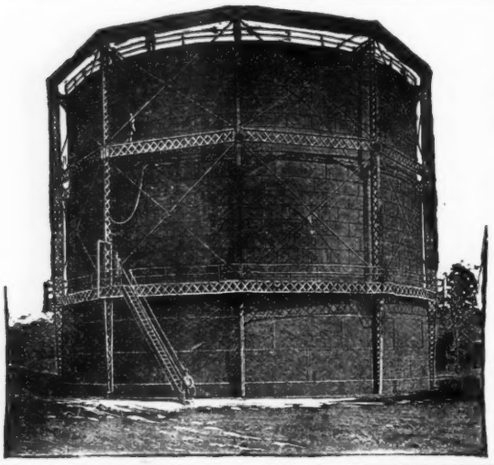

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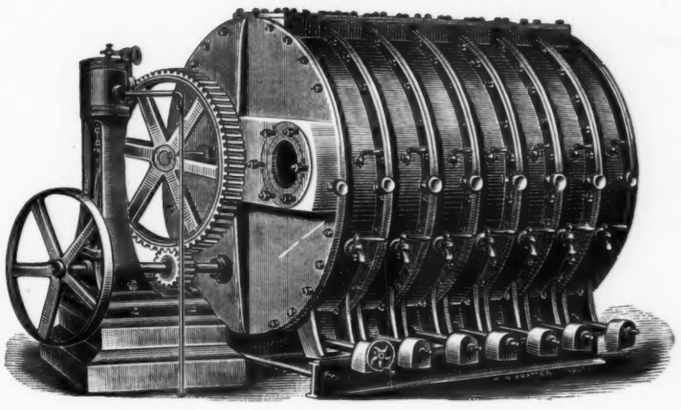

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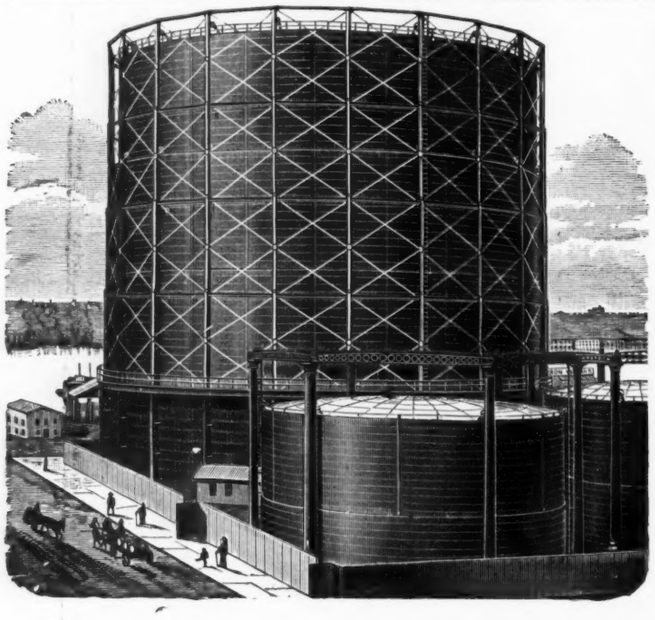

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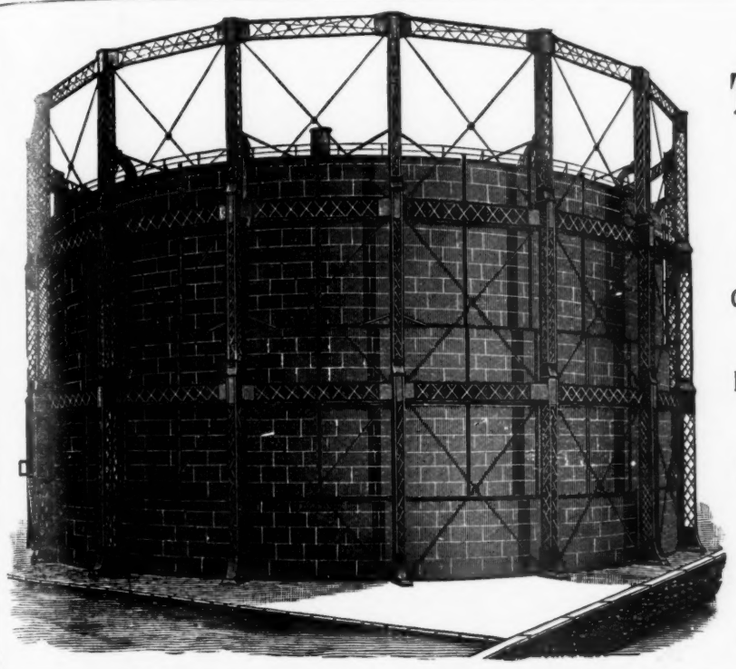

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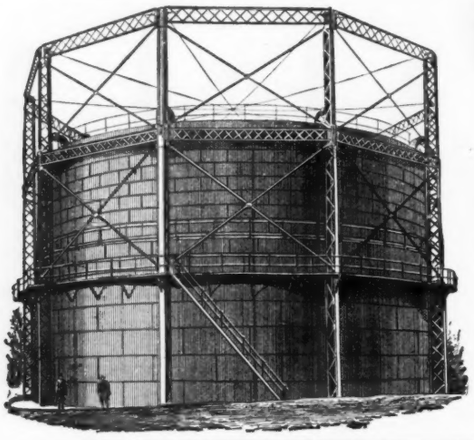

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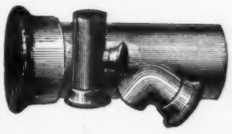

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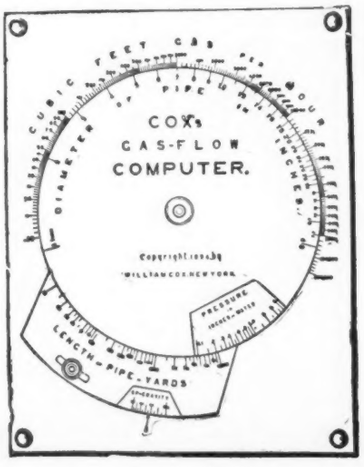

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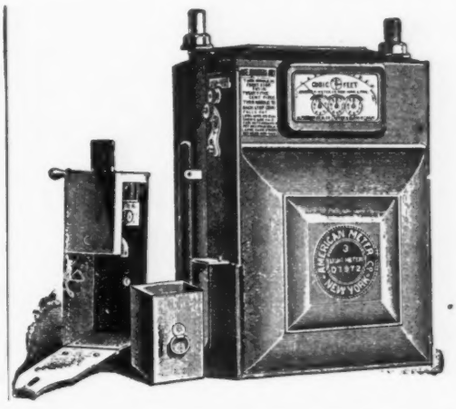

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